Mitigation Plan
for
Stream and Wetland Impacts

Warden Waste Site
Ohio County, Kentucky

Prepared for:

Armstrong Coal Company
407 Brown Road
Madisonville, KY 42431

Prepared by:

T.H.E. Engineers, Inc.

2331 Fortune Drive, Suite 295
Lexington, Kentucky 40509
(859) 263-0009

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Stream and Wetland Mitigation Plan

On-site Mitigation

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C. Compensatory Mitigation: Warden Waste Site

On-Site Mitigation

(1) Goals and Objectives

Streams will be restored on-site and will perform the same functions as the existing streams as described in the baseline report. The goal of the stream mitigation will be to provide in-stream habitat and to construct stable stream systems that convey the bankfull discharge and sediment supplied by the watershed. For the on-site restored streams, dimensions, patterns, and profiles will be constructed so as to create stream types that would naturally occur within the proposed valleys and hydrologic conditions. Existing wetland functions are described in the baseline report. Mitigation for wetlands will occur on an off-site location; please refer to the Off-Site Mitigation section of this report for information.

(2) Site Selection

The on-site streams to be mitigated are all within the Elk Creek watershed, in an area where temporary top soil/cover material storage is proposed for use in the reclamation of the waste disposal development site. This area will not be mined, and once the material is removed during reclamation, it will allow for streams to be restored in their approximate original locations with similar drainage areas and gradients.

(3) Baseline Information

(a) On-site mitigation will consist of restoring entire reaches of intermittent streams and ephemeral tributaries; focusing on reestablishing the watersheds with existing stream locations and drainage patterns. Wetlands will be both created and preserved on the off-site mitigation area to be discussed later in this report.

(b) It is proposed that a total of 4,173 feet of ephemeral and 2974 feet of intermittent stream will be restored on-site.

(c) The aquatic resource type includes ephemeral and intermittent and wetlands.

(d) Please refer to the "Stream Habitat Assessment and Wetland Delineation Report" prepared for Armstrong Coal Company, dated January 18, 2013, for existing conditions of on-site streams. The on-site (and off-site mitigation site) is located within two twelve-digit Hydrologic Unit Codes (HUC's); the Elk Creek-Green River (051100030505) and Nelson Creek-Green River (051100030504). According to NRCS climate data, the region receives approximately 48 inches of rainfall per year

(4) Mitigation Work Plan

(a) Boundaries of the proposed mitigation sites are provided in the exhibits.

(b) On-site stream construction will be conducted concurrently with the reclamation phase of the project. Stream construction will be integrated within valleys having characteristics corresponding to appropriate stream types. Valley morphology will consist of landform features that will correspond to proposed stream system morphology including meander planform (radius of curvature, wavelength, belt width and sinuosity), channel profile morphology (riffle/pool or step/pool bed features) and cross section dimensions (low flow, bankfull and flood prone).

On-site stream construction sequence will be as follows:

1. Locate and flag proposed thalweg.
2. Excavate corresponding bankfull width to bankfull elevation as indicated on plans.
3. Excavate bankfull channel to dimensions indicated on profile and cross sections.
4. Grade side slopes to obtain appropriate flood prone width.
5. Grade side slopes to tie into existing ground.
6. Install in-stream structures.
7. Add substrate in riffle and run sections if necessary to provide armoring and riffle habitat.
8. Prepare streambanks and riparian area for seeding.
9. Seed area with native seed mixture as indicated on planting detail sheet.
10. Install erosion control blanket as needed.
11. Plant USACE approved trees and shrubs.

(c) Proposed on-site streams will have similar drainage patterns and connectivity as existing conditions.

(d) For on-site stream restoration native vegetation to be planted along stream banks and riparian zones include the following species or species available at the time of ordering and approved by USACE:

Grasses - Virginia wild rye (*Elymus virginicus*), Switchgrass (*Panicum virgatum*), Rough barnyard grass (*Echinochloa muricata*), Big bluestem *(Andropogon gerardii)*, Forking panic grass/smooth panic grass *(Dichanthelium dichotomum/dichotomiflorum)* and Annual rye (*Lolium perenne*).

Shrubs – Rough-leaf dogwood (*Cornus drummondii*), Strawberry bush (*Euonymus americanus*), and Indigo-bush (*Amorpha fruticosa*). Shrubs will be 3-gallon container grown, planted on a four foot spacing along the streambanks at the bankfull elevation where needed to aid in bank stabilization.

Trees – For intermittent streams: Shellbark hickory (*Carya laciniosa*), Willow oak (*Quercus phellos*), Cherrybark oak (*Quercus pagoda*), Water oak *(Quercus nigra)*, and White oak (*Quercus alba*). For ephemeral streams: Shagbark hickory *(Carya glabra)*, American beech *(Fagus grandifolia)*, Shingle oak *(Quercus imbricaria)*, Post oak *(Quercus stellata)*, and Shumard oak *(Quercus shumardii).* Trees will be either 3-gallon container grown RPM planted at a rate of 60 trees per acre, or 3-gallon non-RPM planted at a rate of 120 trees per acre, or non-RPM bare root seedlings (minimum of 30 inches in height) planted at a rate of 450 stems per acre. The option utilized will be dependent on plant availability at the time of mitigation planting (if plant availability is not an issue, more than one option may be utilized to compare survival rates for future mitigation projects). In addition, a single row of shrubs will be planted along edge of stream just above bankfull elevation where needed to aid in bank stabilization . Shrub spacing will be approximately four feet on average with higher densities at high shear locations (ex. outside bends).

Per Kentucky Division of Mine Permits (KDMP) requirements: planting of woody species will occur during first dormant season following stream restoration.

(e) Any vegetation that would hinder planting or provide excessive competition to natural regeneration of planted species will be removed with appropriate treatment and documented in each annual monitoring report.

(f) Exotic vegetation control: The following efforts will be made to reduce introduction and dispersal of invasive species: removal of exotic species before mitigation begins, cleaning equipment before it reaches the site, inspecting labels on seed mixtures and mulch for composition and vegetative monitoring during the required monitoring period. Volunteers, invasives, and/or exotic vegetation along riparian zones or within created wetland areas will be removed by mowing, digging, spraying, burning or a combination of these during annual maintenance; and documented in each annual monitoring report.

(g) Proposed mitigation plan sheets provide elevation and slope details for the restored stream designs, and details on specific enhancement efforts and wetland creation.

(h) Erosion control methods will consist of the following: constructing or enhancing stream channels during low or no flow periods, allowing vegetation to become established before flow is allowed into the stream restoration channels, applying seed and installing erosion control blanket immediately after final grading, planting trees and shrubs and installing silt fence as needed. Stream restoration and enhancement will proceed in a downstream direction to avoid re-suspension of sediment.

(i) Proposed stream restoration and stream enhancement designs are based on geomorphic and hydrologic principles incorporated with natural channel design techniques utilizing in-stream structures for habitat diversity and stream bank protection.

(j) Proposed Stream Plans will indicate stream type, pattern, profile and dimensions for each stream. Stream morphology was determined by using regional curve data, collecting and studying data from the existing streams, sediment transport and hydrologic calculations, and experience designing and constructing streams.

(k) Natural channel design methods, in-stream structures, and habitat enhancement features will be incorporated into the mitigation plan. Habitat enhancement features will consist of cover logs, log overhangs, submerged logs, and log/rock vane structures. These features will also provide bank stability while vegetation becomes established. Stream enhancement efforts will also include the installation of grade control structures to raise incised streambeds in order to promote reconnection to the floodplain. This effort will allow for establishment of wetlands in the floodplain of those streams. For the stream restoration efforts, the substrate will consist of soils used during reclamation. If it is determined during the stream construction that adequate riffle material is not present, then appropriately sized material will be supplied to riffle and run sections.

(l) Mitigation sites will be permanently protected and maintenance will be provided as needed, throughout the monitoring period. Site protection will be provided through use of a restrictive covenant. Maintenance will include elimination of volunteer species by use of general or spot applications of herbicides, hand picking and mowing, where appropriate.

(m) A representative from the design team will be on site during critical phases of the construction process. The representative will make periodic site visits and will familiarize construction personnel with design plans and restoration methods.

(5) Performance Standards/Success Criteria

(a) Standards for assessing stream mitigation goals include:

1. Streams to be restored on-site must be constructed to meet the dimension, pattern and profile of the indicated Rosgen Stream Type.
2. There should be no signs of excessive stream bank erosion or severe headcutting.
3. At the end of the monitoring period, the streams shall have average riffle cross section dimensions reflective of the indicated Rosgen Stream Type.
4. At the end of the monitoring period, the restored on-site streams shall have minimum EPA Rapid Bioassessment Protocol scores in the sub-optimal range.

5. Root Production Method (RPM) trees will be planted at a rate of 60 trees per acre, or non-RPM 3-gallon container grown will be planted at a rate of 120 trees per acre, or bare root seedlings (minimum height of 30 inches) will be planted at a rate of 450 trees per acre. The option utilized will be dependent on plant availability at the time of mitigation planting (if plant availability is not an issue, more than one option may be utilized to compare survival rates for future mitigation projects).

6. Riparian vegetation shall have at least an 80% survival rate of the initial planting of non-RPM or bare root seedlings; with no single planted tree species constituting more than 25 percent of the surviving species. The survival rate for RPM plantings is 90 percent. No one species shall comprise more than 25 percent of the surviving RPM plantings.

7. Riparian vegetation will consist of no volunteer tree species at the end of the monitoring period.

8. Per Kentucky Division of Mine Permits (KDMP) requirements: one measure of project success will be final stream assessment scores that equal or exceed pre-project scores.

9. In the riparian areas, herbaceous plantings must provide a minimum of 70 percent ground cover; with no one species accounting for more than 40 percent ground cover.

10. Linear footage and flow regimes will match the USACE approved mitigation plan.

11. Streams will have a definable bed and bank, with an Ordinary High Water Mark.

12. Stream channel and in-stream structures must be stable and functioning as designed.

13. Stream morphology must meet the proposed Rogsen classification (i.e., stream slope, sinuosity, belt width, meanders, bankfull cross-sectional area, width/depth ratios).

14. Annual monitoring should indicate that mitigation is progressing toward meeting success criteria.

(b) Adaptive Management

If success criteria are not met during the monitoring period, an analysis of the contributing conditions will be conducted and documented. Remedial action, if required by USACE, will be performed and documented by the applicant. Remedial actions may include replanting trees and shrubs, reseeding grasses, adjusting in-stream structures and repairing eroded banks. These actions will be performed at least twice, depending on the nature of the problem. Should these efforts not resolve the issue, another site will be found to replace failed sections of the mitigation sites. The contingency plan for proposed ephemeral and intermittent streams will be payment of in-lieu fees. For intermittent streams, contingency payment will be based on the length of stream that does not support intermittent hydrology during the monitoring period. For ephemeral streams, it is based on the length of stream of channel that does not meet performance standards.

(c) Project Performance Evaluations

All stream and wetland sites will be monitored in accordance with the Mitigation Final Rule, 2008. In general, the following guidelines will be used:

1. The monitoring period must be sufficient to demonstrate that the compensatory mitigation has met performance standards. The monitoring period length shall be a minimum of five years unless performance standards are met in less than five years. In this case, the monitoring period length can be reduced if there are at least two consecutive monitoring reports that demonstrate that performance standards have been met. Longer monitoring timeframes are necessary for compensatory mitigation projects that take longer to develop.
2. Biannual inspections will be conducted each year during the first and last month of the growing season.
3. The first monitoring report will be due after the first full growing season following the initial planting.
4. Monitoring reports are due to USACE by January 31 for the previous year, and to the Kentucky Division of Mine Permits (KDMP) by December 31 for the same monitoring year.
5. Photo stations and monitoring stations will be at the same location.
6. Permanent photo/monitoring stations will be set at a minimum of 1 per 1500 feet of ephemeral stream, and 1 per 500 feet of intermittent and perennial stream.
7. The same monitoring stations shall be used every year.
8. Personnel familiar with natural stream design principles will perform monitoring tasks.
9. Stream monitoring will consist of assessing stream parameters and documenting vegetation survival.
10. Stream channel form and in-stream structure stability will be monitored to ensure stream functionality. Maintenance will be performed if the following conditions develop: excessive bank erosion occurs (RBP scores in the marginal range for bank stability), erosion around or under structures that would render them ineffective or cause structure collapse, excessive siltation of pools reducing their effectiveness in reducing energy and/or adversely affecting pool habitat, and upstream directed vertical bed erosion (headcut) that would jeopardize structure stability and lead to unstable channel conditions (RBP scores in marginal range for epifaunal/substrate cover or sediment deposition). Stream conditions will be inspected frequently by design and/or stream construction team. Stream channel maintenance will be performed as needed to ensure stream stability, function and value.
11. Water quality monitoring will be conducted in accordance with the approved SMCRA/KPDES permit, which states:

Beginning at the time of initial disturbance within the respective watershed, grab samples will be collected from the KPDES point twice each month during the active permit operation phase and reclamation phase and will continue until Phase I bond release. After Phase I bond release, monitoring at the discharge point will be on a once per month basis for six months followed by quarterly sampling thereafter (unless specifically disallowed by the regulatory authorities) continuing until final bond release or when KPDES monitoring is otherwise no longer required by the regulatory authorities.

Prior to Phase I bond release the parameters to be monitored at the discharge point will be, when appropriate: flow (estimated), acidity, alkalinity, total iron, total manganese, pH, total suspended solids and settleable solids. After Phase I bond release the parameters to be monitored will be: flow (estimated), pH, acidity, alkalinity, and settleable solids (when acceptable and appropriate total suspended solids may be analyzed instead of settleable solids). Discharge limitations for these parameters will be as specified in the KPDES permit issued for the discharge.

Monitoring results obtained during the previous three months will be summarized for each discharge for each month and reported on a Discharge Monitoring Report Form, as required. Signed forms as well as all other reports required will be submitted to the appropriate DMRE regional office within 30 days following the end of each quarter. If the results of any KPDES discharge monitoring data collection indicate noncompliance with a permit condition, then the permittee shall promptly notify the cabinet and shall take immediate corrective actions to return the operations to compliance with all permit conditions. Specialized requirements for compliance with KPDES regulations (e.g. alternate rainfall sampling requirements and limitations, special noncompliance notifications, signatories requirements, testing procedures, recording of results, records of retention, management requirements, other responsibilities, etc.) will be as specified in the KPDES permit issued for the discharge.

Water quality monitoring locations will be at basin outfalls. Results will be submitted to USACE as part of stream monitoring reports.

12. Monitoring reports will include a discussion of inspection findings. Conditions such as bank erosion, streambed characteristics and vegetation survival will be documented. Stream assessments will be conducted and RBP scores will be compared to pre-disturbance scores

and previous monitoring scores to determine if mitigation is progressing towards meeting goals. Any problems will be identified and remedial action taken.

13. Parties responsible for monitoring will be Armstrong personnel familiar with the project and natural channel design, or USACE-approved consultants.

14. RBP assessments will be used to assess physical quality of stream and will include conductivity, pH and temperature readings. Monitoring reports will include photographic documentation of streams and riparian vegetation. In addition, riparian vegetation will be inspected and density, survivorship, composition, percent cover and any non-native species will be documented. Macroinvertebrate and fish surveys will be conducted, as required. The Kentucky Division of Water's "Methods for Sampling Benthic Macroinvertebrates Communities in Wadeable Waters" will be followed.

15. When petitioning the Corps for release of mitigation requirements, a full stream delineation for the mitigation site will be provided (e.g. linear footage, Rosgen, RBP, flow regimes, riffle/pool count, riparian vegetation survivability).

16. With the first annual report, as-built drawings for the constructed stream mitigation, watershed drainage area, and reclaimed geomorphological landscape will be provided.

17. Data collected at the permanent monitoring stations shall, at a minimum, include Rosgen analysis and RBP characterization/habitat measurements. Data will be recorded on appropriate documents.

18. Annual macroinvertebrate and fish sampling will commence the first full year after construction.

(6) Project Success

The applicant will be responsible for all mitigation including construction oversight, monitoring and reports, corrective measures, site access control and protection. The surface mining operation will obtain and submit to KDMP a certification from a registered professional engineer that all mitigation work has been completed in accordance with the conditions of the Water Quality Certification.

(7) Site Protection

Site protection will be provided through use of a restrictive covenant. The restrictive covenant will be executed after completion of the mitigation construction. It will be recorded within 60 days after mitigation construction completion, with USACE notification of recording at the time of execution. Durable signs will be placed identifying all mitigation sites as areas not to be disturbed. They will be placed on approximately 500 foot intervals along streams and along the

perimeter of the wetland. The mitigation sites will be integrated into the reclamation plan, with limited site access.

(8) Contingency Plan

If success criteria are not met for any portion of the monitoring year and/or final success criteria are not satisfied, an analysis of the contributing conditions will be conducted and documented. Remedial action, if required by USACE, will be performed and documented by the applicant. Should these efforts not resolve the problem, the contingency plan for proposed ephemeral and intermittent streams will be payment of in-lieu fees. For intermittent streams, contingency payment will be based on the length of stream that does not support intermittent hydrology during the monitoring period. For ephemeral streams it is based on the length of channel that does not meet performance standards.

(9) Monitoring and Long-Term Management

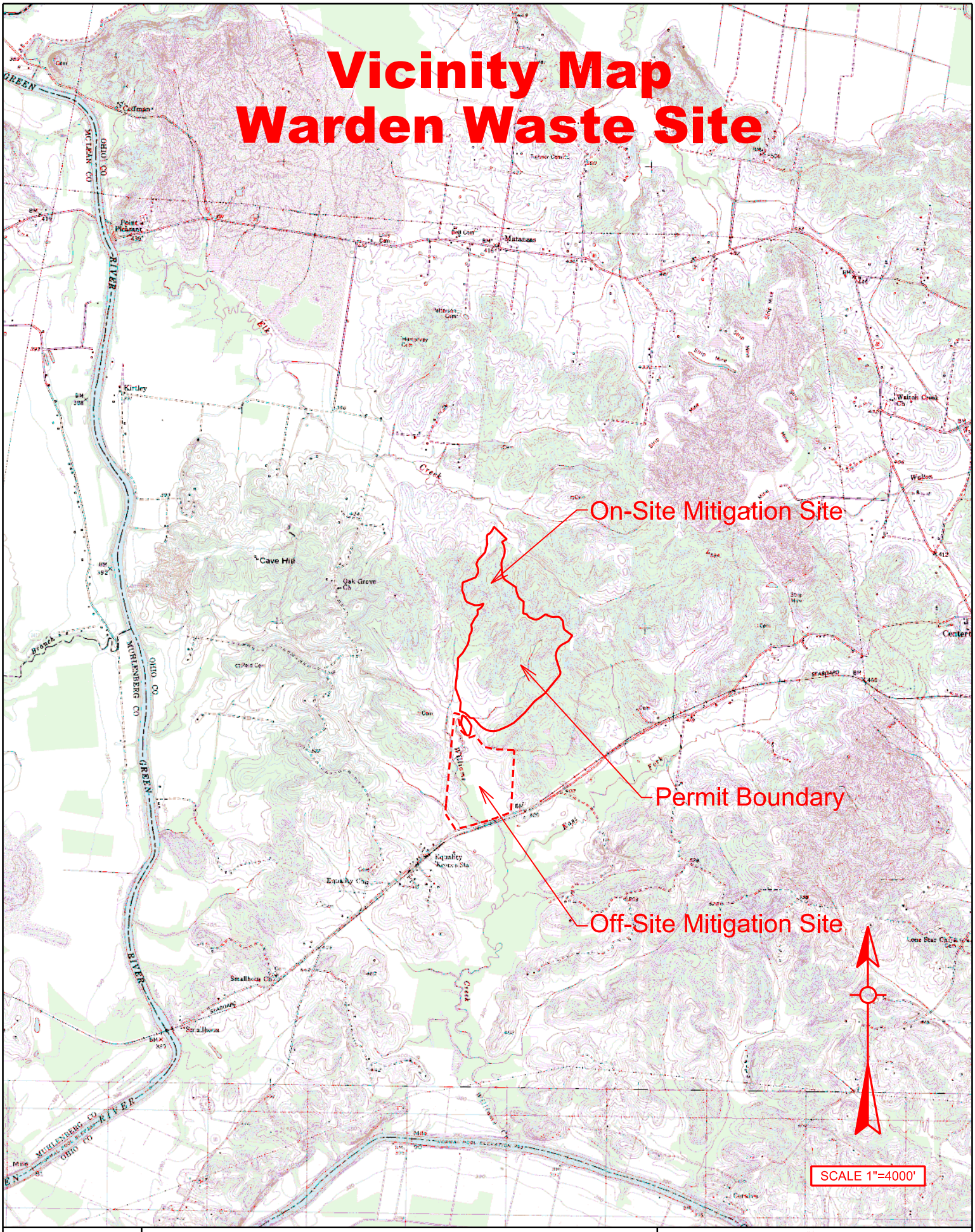
(a) The applicant will be responsible for accomplishing, maintaining, and monitoring all mitigation sites. Long-term management will include a protective covenant.

(b) Monitoring plans will be provided as discussed under Performance Standards.

(10) Financial Assurances

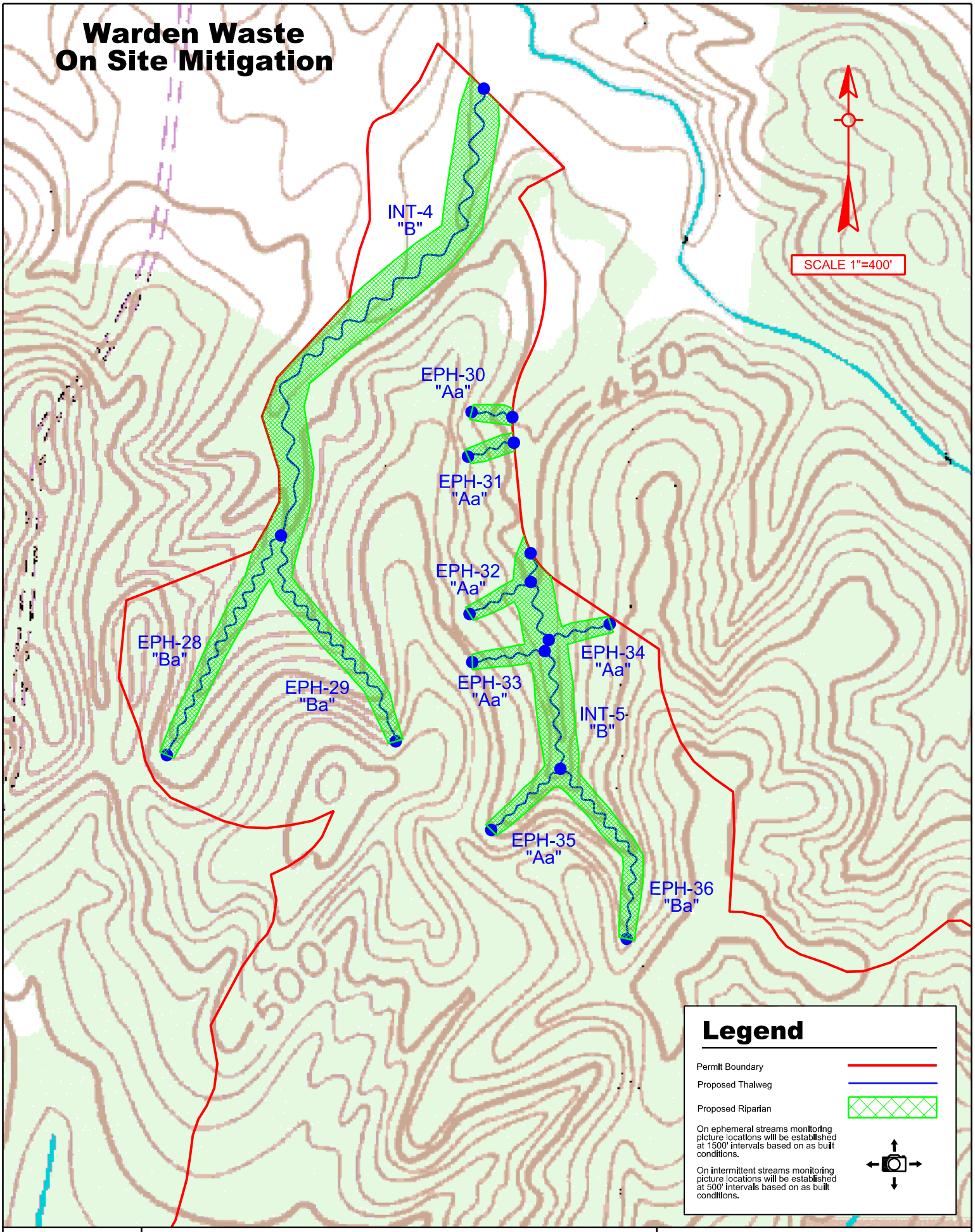
The applicant will be responsible for managing any financial assurances and contingency funds set-aside for remedial measures. The USACE, Louisville District, currently does not have the means to handle financial assurances; therefore, no USACE-managed financial assurances are proposed for this project.

Vicinity Map
Warden Waste Site



T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE			STREAMS: UT's OF WILLIAMS CREEK & ELK CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: VICINITY MAP	EXHIBIT 1

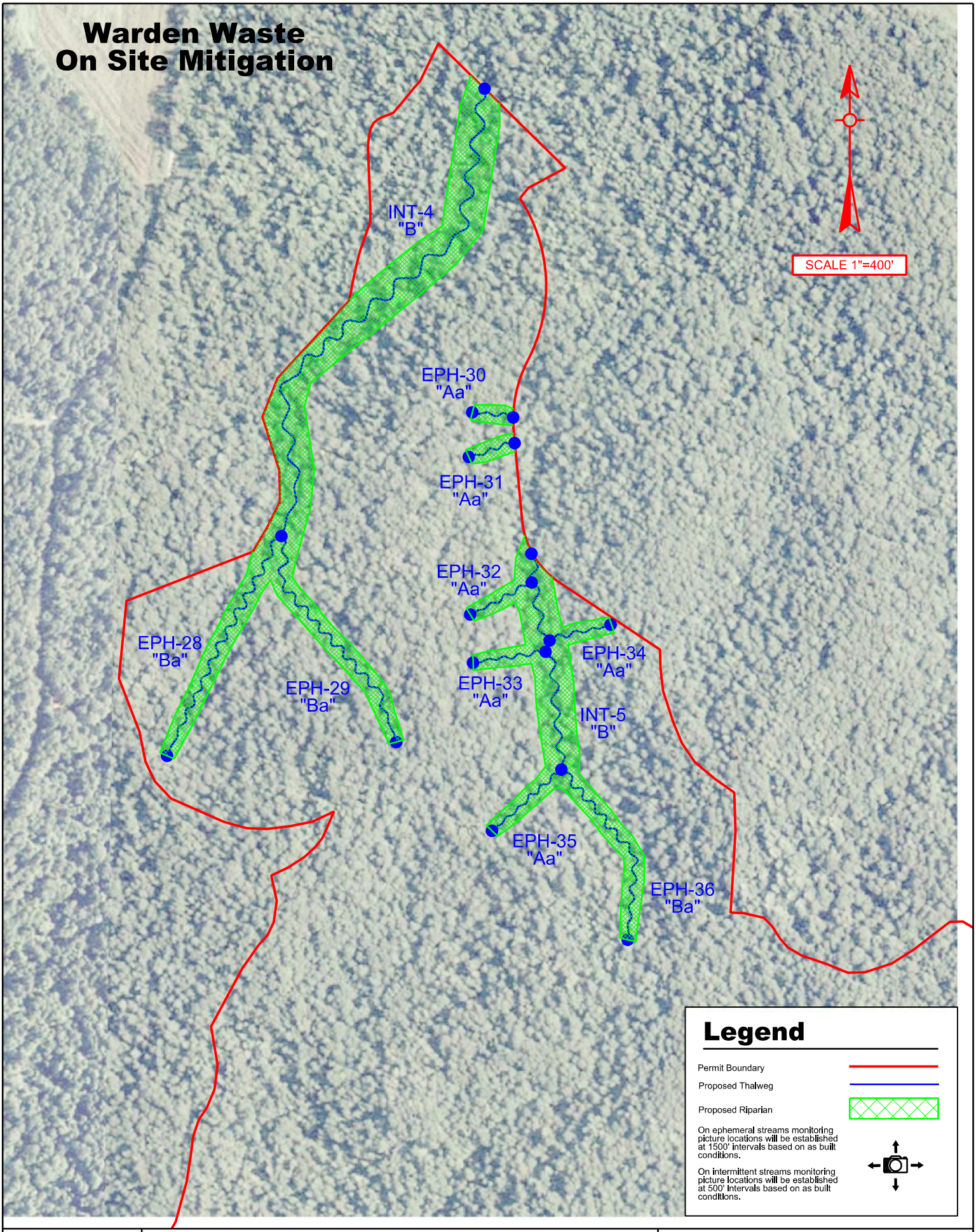
DATE:



T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE - PROPOSED ON-SITE MITIGATION			STREAM: UT'S OF ELK CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: QUAD MAP	EXHIBIT 2

DATE:

Warden Waste
On Site Mitigation



Legend

Permit Boundary

Proposed Thalweg

Proposed Riparian

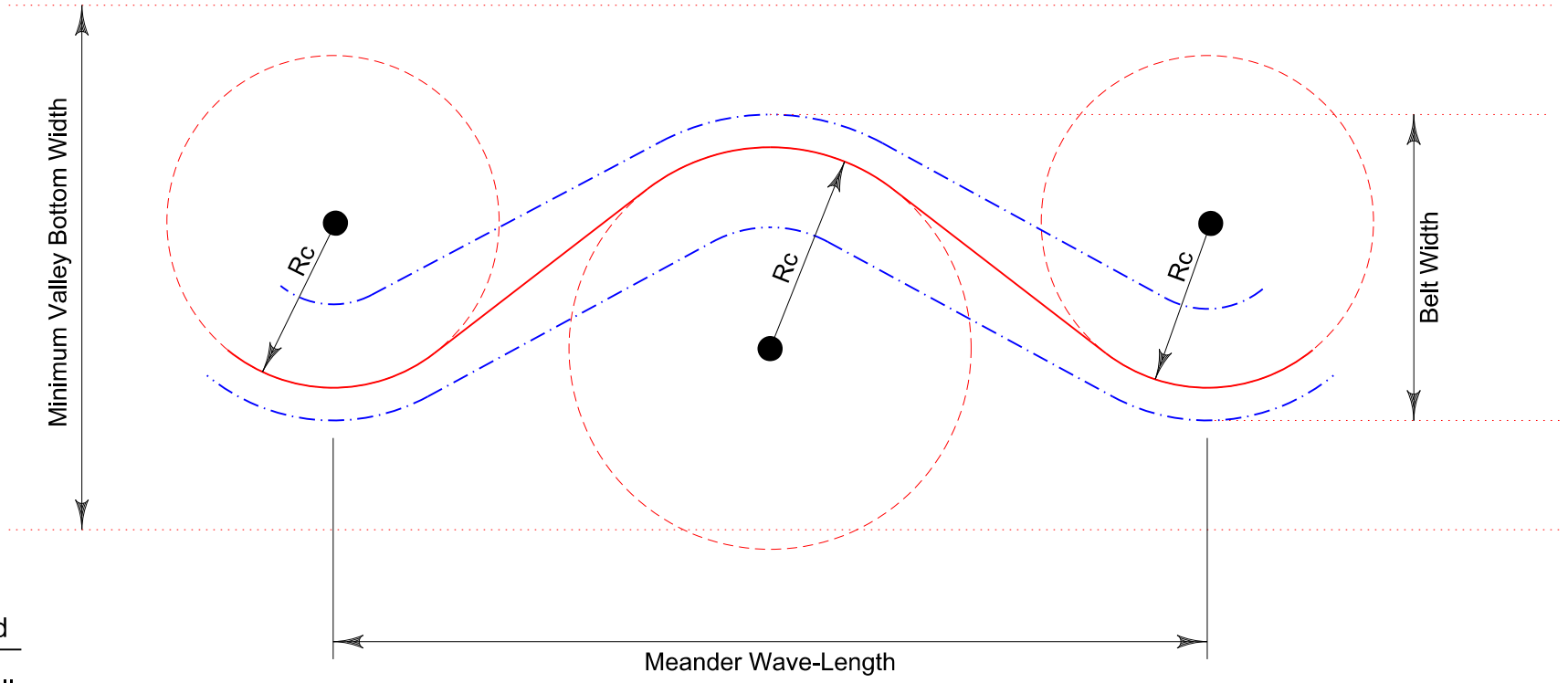
On ephemeral streams monitoring picture locations will be established at 1500' intervals based on as built conditions.

On intermittent streams monitoring picture locations will be established at 500' intervals based on as built conditions.

T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE - PROPOSED ON-SITE MITIGATION			STREAM: UT'S OF ELK CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: AERIAL MAP	EXHIBIT 3

DATE:

Typical Meander Pattern for Rosgen Stream Type "Ba"
Stream EPH-28



Legend

Bankfull

Thalweg

Bankfull Width=4.5'
Radius of Curvature (Rc) Ranges from 11' to 14'
Belt Width Ranges from 18' to 23'
Meander Wave-Length Ranges from 36' to 45'
Approximate Proposed Reach Length = 994'
Proposed Stream Gradient Ranges from 2.9% to 4.6%
Proposed Valley Gradient Ranges from 3.5% to 5.5%
Minimum Valley Bottom Width = 30'

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

ITEM: PROPOSED TYPICAL MEANDOR PATTERN

STREAM: EPHEMERAL 28

EXHIBIT 4

DATE:

T.H.E. Engineers, Inc.

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

ITEM: PROPOSED TYPICAL RIFFLE CROSS SECTION

STREAM: EPHEMERAL 28

EXHIBIT 5

DATE:

EROSION CONTROL BLANKET (may be used as needed)

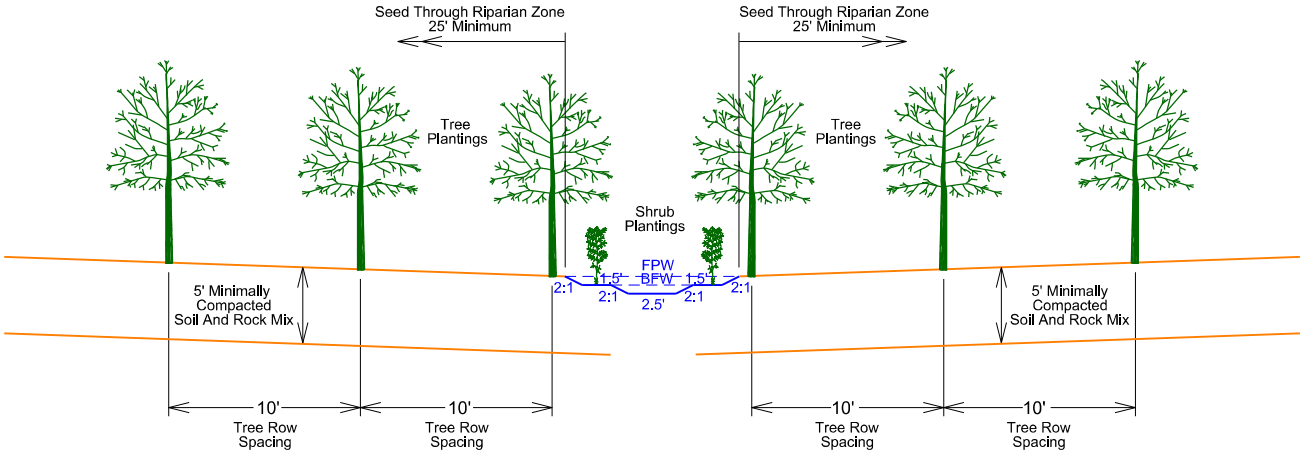
E.C.B. I shall meet the following specifications:
* Netting:Biodegradable, natural fiber.
* Matrix Material:100% coconut fiber.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:2.35 lbs / SQ. FT.
* Velocity:10 feet per second.
* Longevity:up to 24 months.
* North American Green C125 BN or equivalent shall be used.

E.C.B. 2 shall meet the following specifications:
* Netting:100% Biodegradable, natural fiber.
* Matrix Material:100% straw.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:1.855 lbs. / SQ. FT.
* Velocity:6 feet per second.
* Longevity:up to 12 months.
* North American Green S150 BN or equivalent shall be used.

Note
* E.C.B. 1, E.C.B. 2, straw mulch or a combination of each will be used to prevent erosion and assist vegetation establishment along stream banks and throughout the riparian zone. Straw mulch will be crimped, tacked, or held in place with a biodegradable net, as needed.

Proposed Channel Dimensions

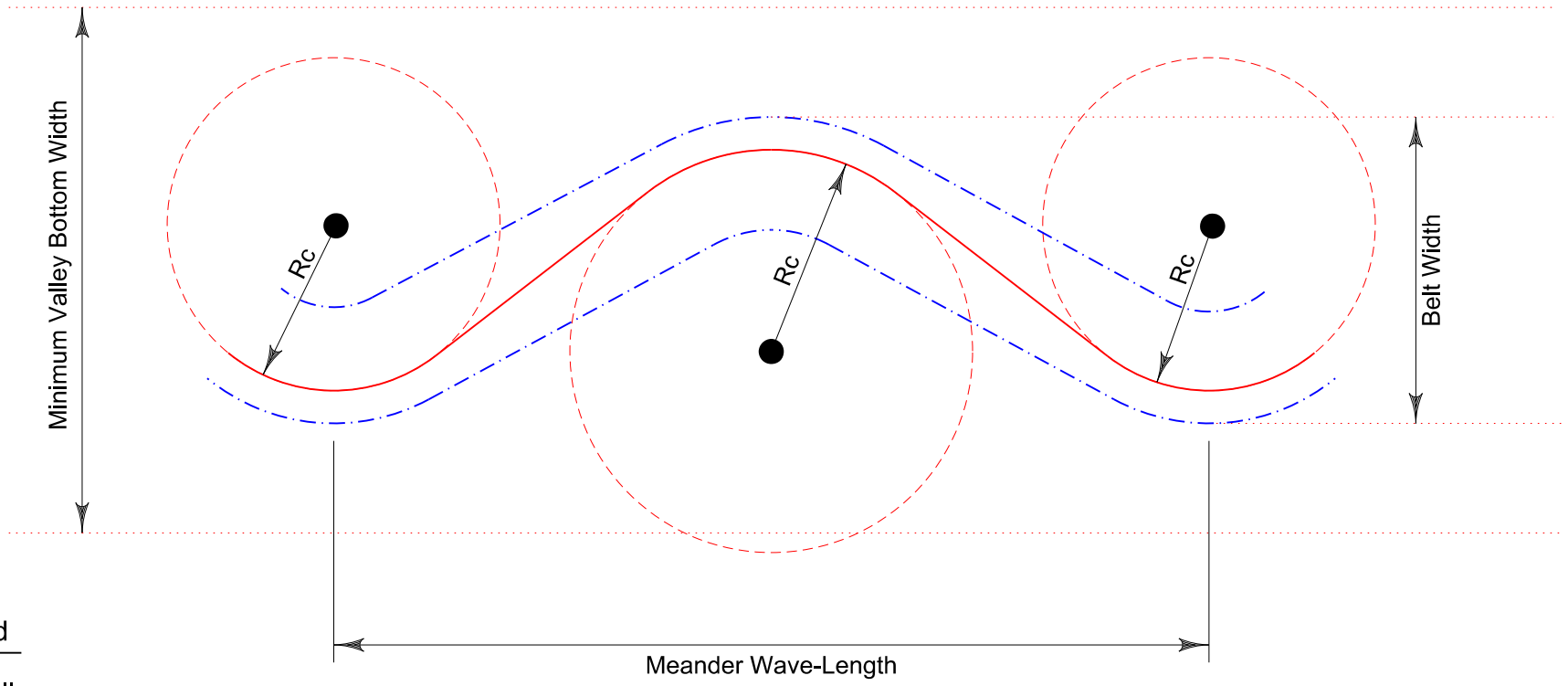
BFW=4.5'
BFA=1.53SF
BF mean D=0.36'
BF max D = 0.45'
FPW= max 10'
W/D=12.5
Entrenchment Ratio 2.2 max
Bench Width= 1.5' max



Note
* Tree spacing shown (10' x 10') is based on bare root seedlings. See mitigation plan for other tree planting options.

Typical Riffle Cross Section Stream EPH-28
Rosgen Stream Type "Ba"
Scale: 1"=10'

Typical Meander Pattern for Rosgen Stream Type "Ba"
Stream EPH-29 & EPH-36



Legend

Bankfull

Thalweg

Bankfull Width=4.5'
Radius of Curvature (Rc) Ranges from 11' to 14'
Belt Width Ranges from 18' to 23'
Meander Wave-Length Ranges from 36' to 45'
See Proposed Mitigation Length Table for Lengths
Proposed Stream Gradient Ranges from 6.0% to 7.0%
Proposed Valley Gradient Ranges from 7.0% to 8.5%
Minimum Valley Bottom Width = 35'

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

ITEM: PROPOSED TYPICAL MEANDOR PATTERN

STREAM: EPHEMERAL 29 & 36

EXHIBIT 6

DATE:

T.H.E. Engineers, Inc.

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

ITEM: PROPOSED TYPICAL RIFFLE CROSS SECTION

STREAM: EPHEMERAL 29 & 36

EXHIBIT 7

DATE:

EROSION CONTROL BLANKET (may be used as needed)

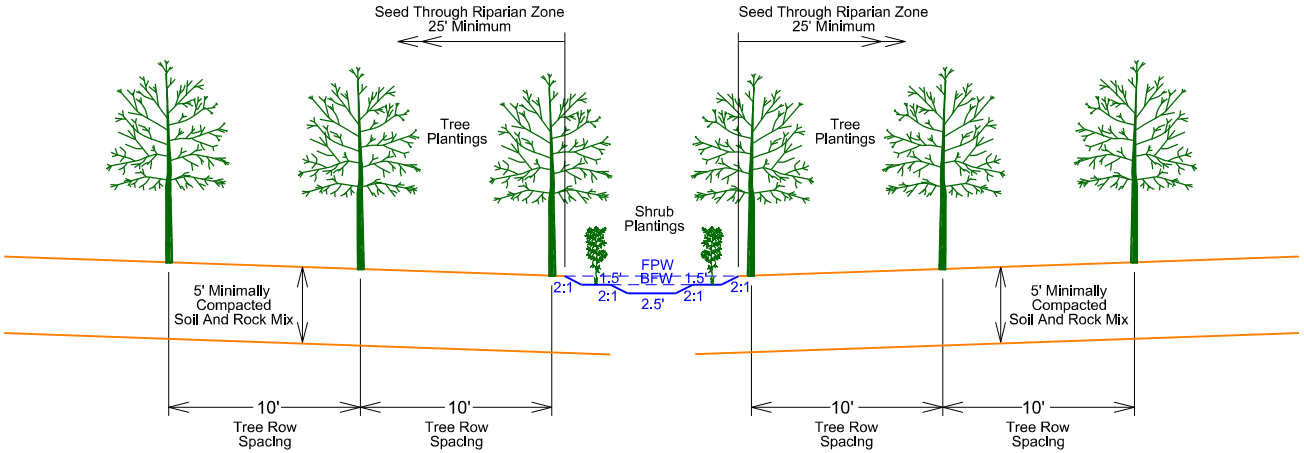
E.C.B. I shall meet the following specifications:
* Netting:Biodegradable, natural fiber.
* Matrix Material:100% coconut fiber.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:2.35 lbs / SQ. FT.
* Velocity:10 feet per second.
* Longevity:up to 24 months.
* North American Green C125 BN or equivalent shall be used.

E.C.B. 2 shall meet the following specifications:
* Netting:100% Biodegradable, natural fiber.
* Matrix Material:100% straw.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:1.855 lbs. / SQ. FT.
* Velocity:6 feet per second.
* Longevity:up to 12 months.
* North American Green S150 BN or equivalent shall be used.

Note
* E.C.B. 1, E.C.B. 2, straw mulch or a combination of each will be used to prevent erosion and assist vegetation establishment along stream banks and throughout the riparian zone. Straw mulch will be crimped, tacked, or held in place with a biodegradable net, as needed.

Proposed Channel Dimensions

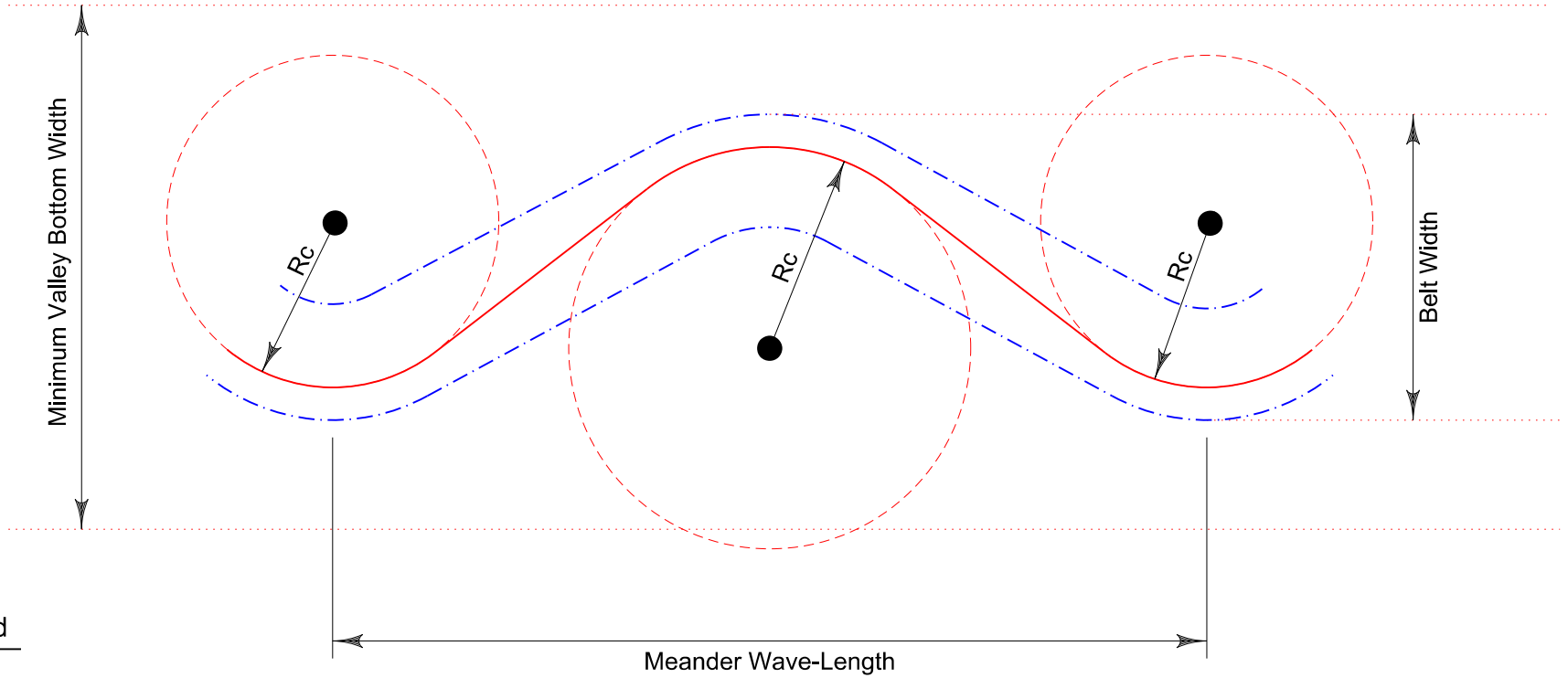
BFW=4.5'
BFA=1.53SF
BF mean D=0.36'
BF max D = 0.45'
FPW= max 10'
W/D=12.5
Entrenchment Ratio 2.2 max
Bench Width= 1.5' max



Note
* Tree spacing shown (10' x 10') is based on bare root seedlings. See mitigation plan for other tree planting options.

Typical Riffle Cross Section Stream EPH-29 & EPH-36
Rosgen Stream Type "Ba"
Scale: 1"=10'

Typical Meander Pattern for Rosgen Stream Type "Aa+"
Stream EPH 30, EPH-31, EPH-32, EPH-33, EPH-34, EPH-35



Legend

Bankfull

Thalweg

Bankfull Width=3.5'
Radius of Curvature (Rc) Ranges from 8.5' to 11'
Belt Width Ranges from 14' to 18'
Meander Wave-Length Ranges from 28' to 35'
See Proposed Mitigation Length Table for Lengths
Proposed Stream Gradient Ranges from 9.0% to 16.5%
Proposed Valley Gradient Ranges from 10.0% to 18.0%
Minimum Valley Bottom Width = 25'

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

ITEM: PROPOSED TYPICAL MEANDOR PATTERN

STREAM: EPHEMERAL 30, 31, 32, 33, 34, 35

EXHIBIT 8

DATE:

T.H.E. Engineers, Inc.

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

ITEM: PROPOSED TYPICAL RIFFLE CROSS SECTION

STREAM: EPHEMERAL 30, 31, 32, 33, 34, 35

EXHIBIT 9

DATE:

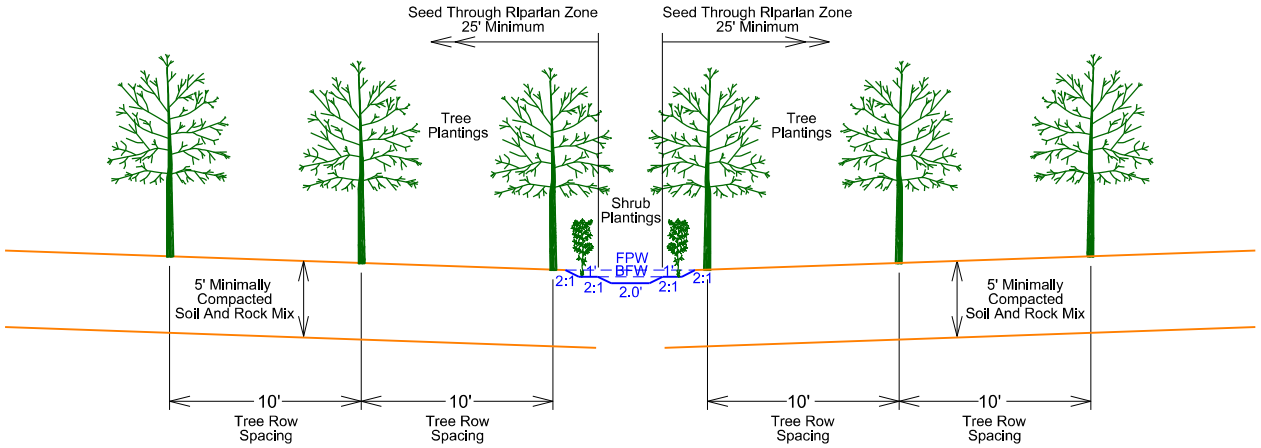
EROSION CONTROL BLANKET (may be used as needed)

E.C.B. I shall meet the following specifications:
* Netting:Biodegradable, natural fiber.
* Matrix Material:100% coconut fiber.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:2.35 lbs / SQ. FT.
* Velocity:10 feet per second.
* Longevity:up to 24 months.
* North American Green C125 BN or equivalent shall be used.

E.C.B. 2 shall meet the following specifications:
* Netting:100% Biodegradable, natural fiber.
* Matrix Material:100% straw.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:1.855 lbs. / SQ. FT.
* Velocity:6 feet per second.
* Longevity:up to 12 months.
* North American Green S150 BN or equivalent shall be used.

Note
* E.C.B. 1, E.C.B. 2, straw mulch or a combination of each will be used to prevent erosion and assist vegetation establishment along stream banks and throughout the riparian zone. Straw mulch will be crimped, tacked, or held in place with a biodegradable net, as needed.

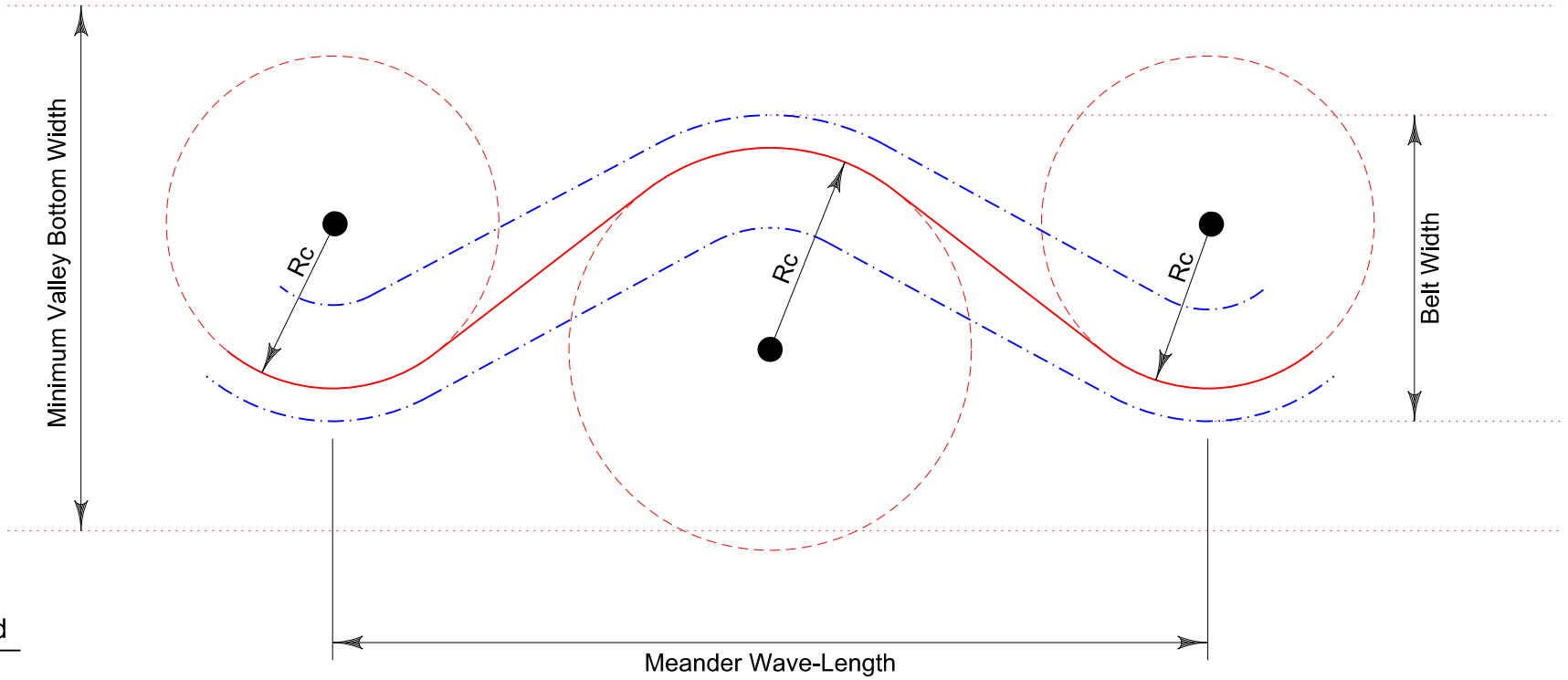
Proposed Channel Dimensions
BFW=3.5'
BFA=1.0SF
BF mean D=0.29'
BF max D = 0.35'
FPW= max 7.0'
W/D=12.1
Entrenchment Ratio (1.4 to 2.2)
Bench Width= 1.0' max



Note
* Tree spacing shown (10' x 10') is based on bare root seedlings. See mitigation plan for other tree planting options.

Typical Riffle Cross Section Stream EPH-30, EPH-31, EPH-32, EPH-33, EPH-34, EPH-35
Rosgen Stream Type "Aa+"
Scale: 1"=10'

Typical Meander Pattern for Rosgen Stream Type "B"
Stream INT-4



Legend

Bankfull

Thalweg

Bankfull Width=7.8'
Radius of Curvature (Rc) Ranges from 19' to 24'
Belt Width Ranges from 31' to 39'
Meander Wave-Length Ranges from 62' to 78'
Approximate Proposed Reach Length = 2100'
Proposed Stream Gradient Ranges from 1.5% to 3.0%
Proposed Valley Gradient Ranges from 2.0% to 3.5%
Minimum Valley Bottom Width = 45'

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

ITEM: PROPOSED TYPICAL MEANDOR PATTERN

STREAM: INTERMITTENT 4

EXHIBIT 10

DATE:

T.H.E. Engineers, Inc.

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

ITEM: PROPOSED TYPICAL RIFFLE CROSS SECTION

EXHIBIT II

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

STREAM: INTERMITTENT 4

DATE:

EROSION CONTROL BLANKET (may be used as needed)

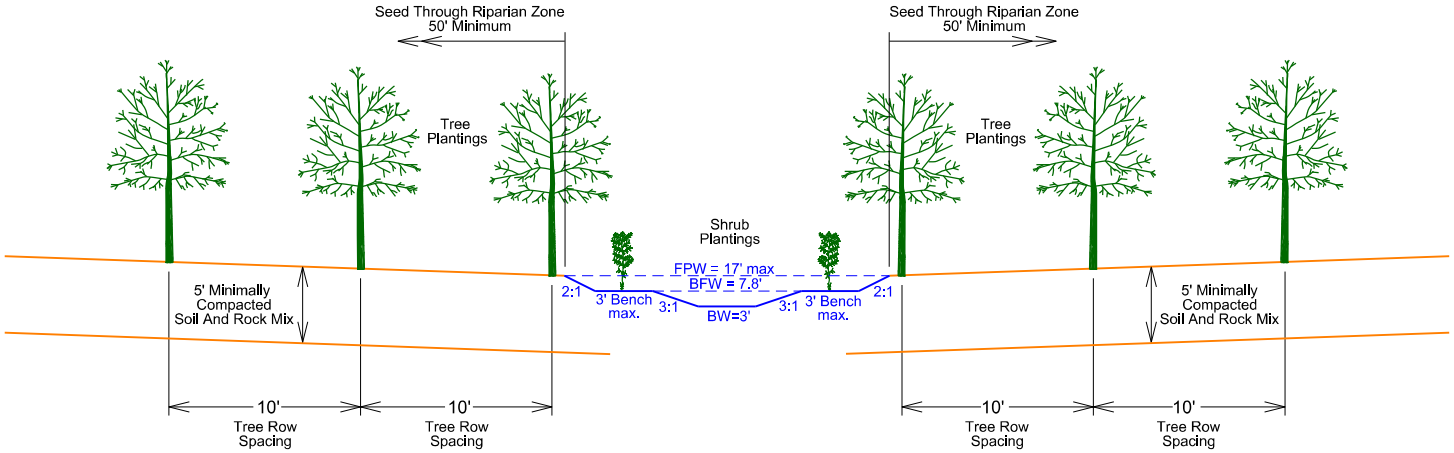
E.C.B. I shall meet the following specifications:
* Netting:Biodegradable, natural fiber.
* Matrix Material:100% coconut fiber.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:2.35 lbs / SQ. FT.
* Velocity:10 feet per second.
* Longevity:up to 24 months.
* North American Green C125 BN or equivalent shall be used.

E.C.B. 2 shall meet the following specifications:
* Netting:100% Biodegradable, natural fiber.
* Matrix Material:100% straw.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:1.855 lbs. / SQ. FT.
* Velocity:6 feet per second.
* Longevity:up to 12 months.
* North American Green S150 BN or equivalent shall be used.

Note
* E.C.B. 1, E.C.B. 2, straw mulch or a combination of each will be used to prevent erosion and assist vegetation establishment along stream banks and throughout the riparian zone. Straw mulch will be crimped, tacked, or held in place with a biodegradable net, as needed.

Proposed Channel Dimensions

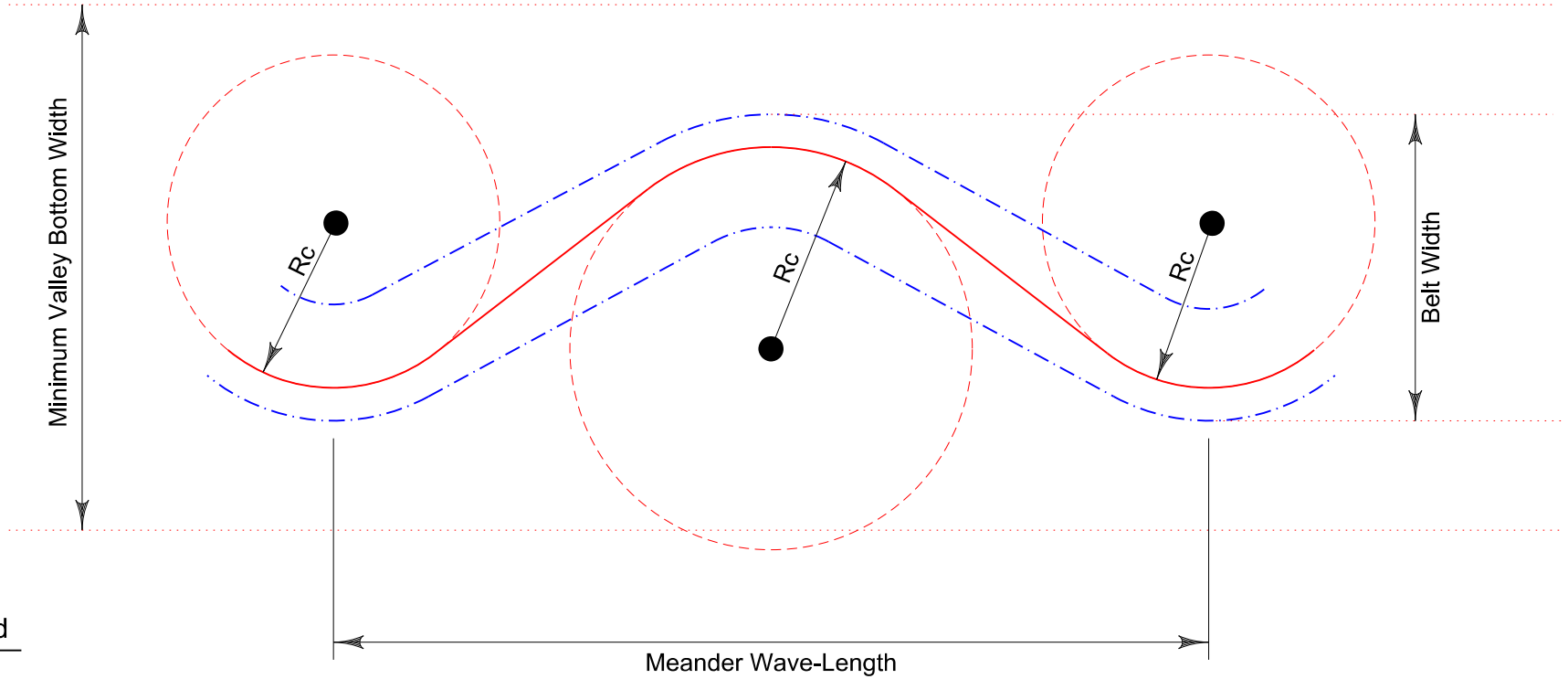
BFW=7.8'
BFA=4.3SF
BF mean D=0.55'
BF max D = 0.8'
FPW= max 17.0'
W/D=14.1
Entrenchment Ratio (1.4 to 2.2)
Bench Width= 3.0' max



Note
* Tree spacing shown (10' x 10') is based on bare root seedlings. See mitigation plan for other tree planting options.

Typical Riffle Cross Section Stream INT-4
Rosgen Stream Type "B"
Scale: 1"=10'

Typical Meander Pattern for Rosgen Stream Type "B"
Stream INT-5



Legend

Bankfull

Thalweg

Bankfull Width=6.0'
Radius of Curvature (Rc) Ranges from 15' to 18'
Belt Width Ranges from 24' to 30'
Meander Wave-Length Ranges from 48' to 60'
Approximate Proposed Reach Length = 875'
Proposed Stream Gradient Ranges from 2.0% to 4.0%
Proposed Valley Gradient Ranges from 2.5% to 4.5%
Minimum Valley Bottom Width = 40'

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

ITEM: PROPOSED TYPICAL MEANDOR PATTERN

STREAM: INTERMITTENT 5

EXHIBIT 12

DATE:

T.H.E. Engineers, Inc.

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

ITEM: PROPOSED TYPICAL RIFFLE CROSS SECTION

EXHIBIT 13

PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION

STREAM: INTERMITTENT 5

DATE:

EROSION CONTROL BLANKET (may be used as needed)

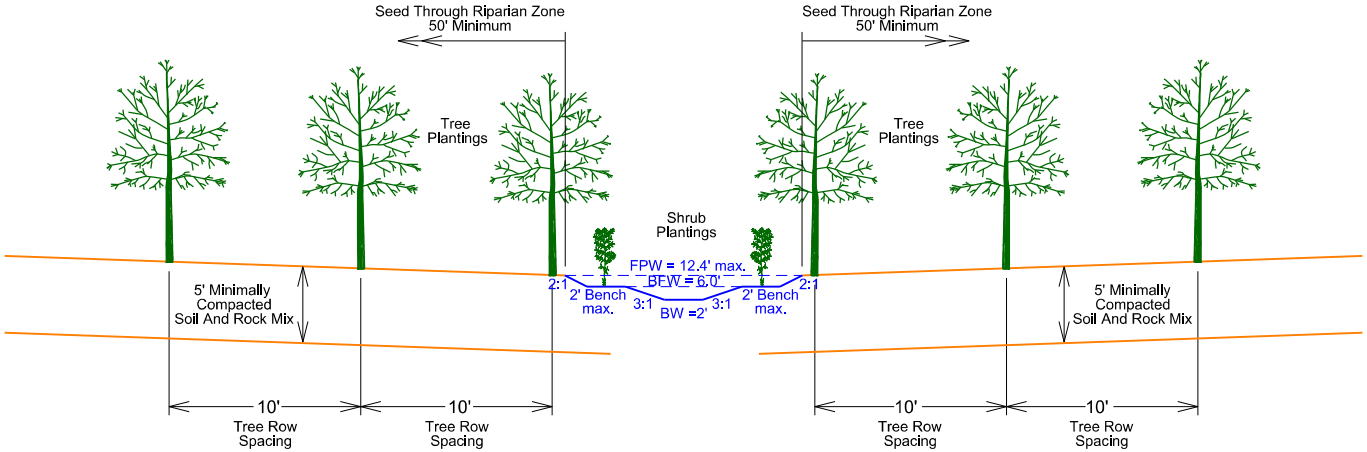
E.C.B. I shall meet the following specifications:
* Netting:Biodegradable, natural fiber.
* Matrix Material:100% coconut fiber.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:2.35 lbs / SQ. FT.
* Velocity:10 feet per second.
* Longevity:up to 24 months.
* North American Green C125 BN or equivalent shall be used.

E.C.B. 2 shall meet the following specifications:
* Netting:100% Biodegradable, natural fiber.
* Matrix Material:100% straw.
* Stitching:Biodegradable thread on 1.5 inch centers.
* Shear stress:1.855 lbs. / SQ. FT.
* Velocity:6 feet per second.
* Longevity:up to 12 months.
* North American Green S150 BN or equivalent shall be used.

Note
* E.C.B. 1, E.C.B. 2, straw mulch or a combination of each will be used to prevent erosion and assist vegetation establishment along stream banks and throughout the riparian zone. Straw mulch will be crimped, tacked, or held in place with a biodegradable net, as needed.

Proposed Channel Dimensions

BFW=6.0'
BFA=2.75SF
BF mean D=0.45'
BF max D = 0.68'
FPW= max 12.4' max
W/D=13.45
Entrenchment Ratio (1.4 to2.2)
Bench Width= 2.0' max



Note
* Tree spacing shown (10' x 10') is based on bare root seedlings. See mitigation plan for other tree planting options.

Typical Riffle Cross Section Stream INT-5
Rosgen Stream Type "B"
Scale: 1"=10'

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION

COUNTY: OHIO

STATE: KY

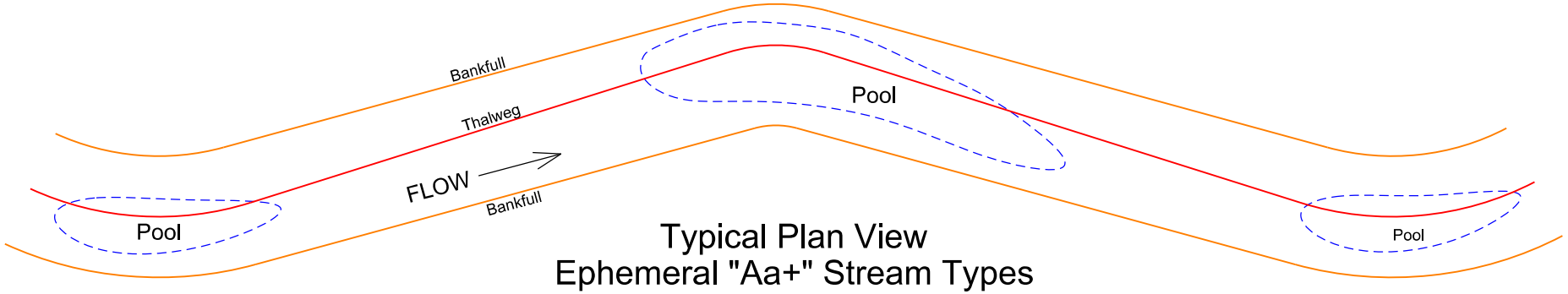
NEAR: CENTERTOWN

ITEM: TYPICAL PLAN AND PROFILE VIEW

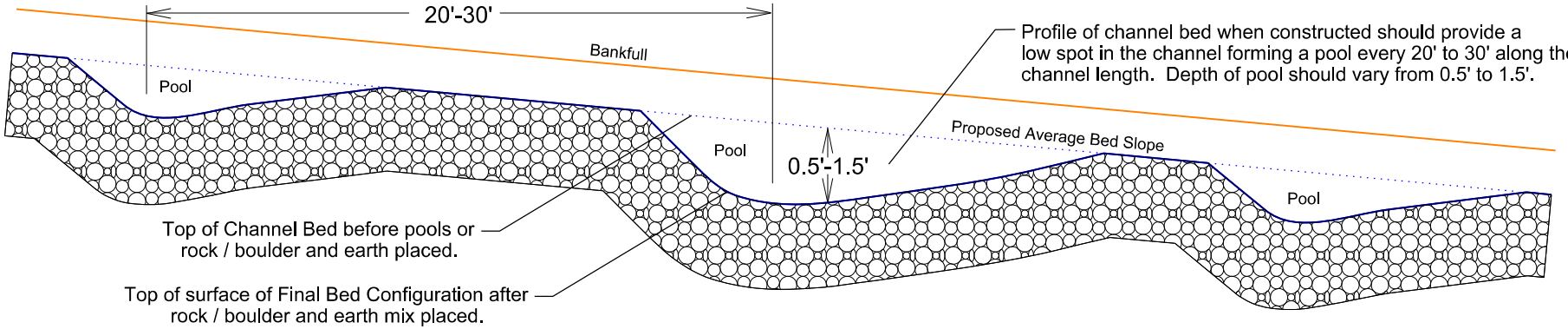
STREAM: EPHEMERAL 30, 31, 32, 33, 34, 35

EXHIBIT 14

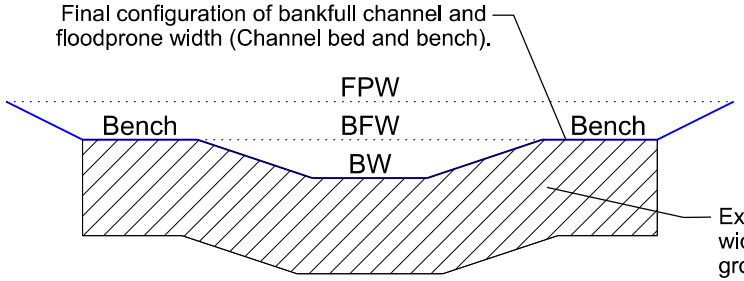
DATE:



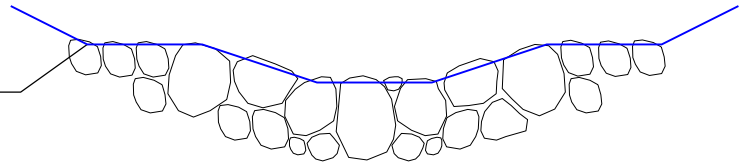
Typical Plan View
Ephemeral "Aa+" Stream Types



Typical Profile View
Ephemeral "Aa+" Stream Types



See Cross Section detail for streams
EPH-30, EPH-31, EPH-32, EPH-33, EPH-34 and EPH-35
for bankfull channel and floodprone width.



Rock and boulder should be approximately 0.5' to 1.0' in diameter on average. Earth mixed with rock and boulders should not exceed 30% of the total mix.

Place a rock / boulder and earth mix in the excavated area until the channel bed and bench are formed as shown on the cross section detail for streams EPH-30, EPH-31, EPH-32, EPH-33, EPH-34 and EPH-35. The rock / boulder and earth mix, when placed, will be tamped in place to give good contact with existing ground and compaction for the mix. Final configuration of the surface below bankfull elevation should be left with rock not uniformly placed to increase surface roughness. Final configuration of the surface on bench areas should be compacted tightly to form as smooth a surface as practical. Earth may be added over the bench areas to fill voids and smooth the surface.

Typical Cross Section View
Ephermeral "Aa+" Stream Types

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION

COUNTY: OHIO

STATE: KY

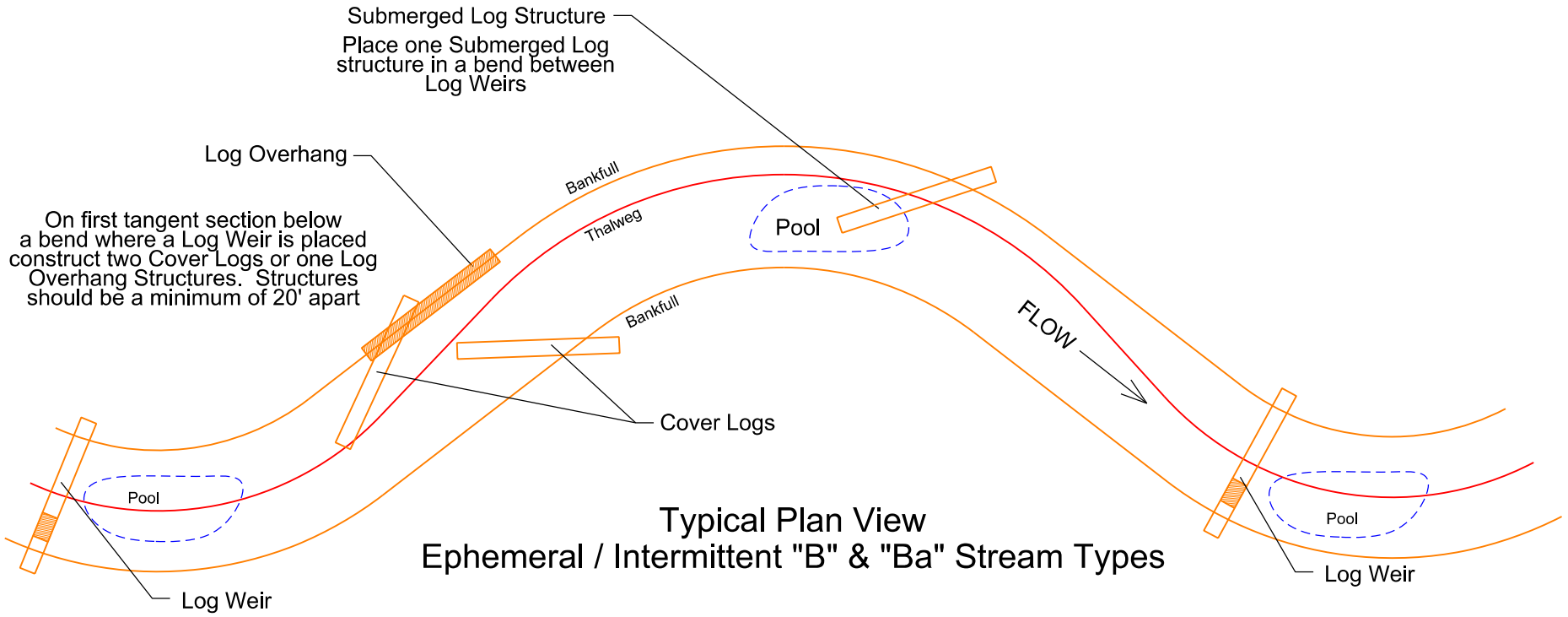
NEAR: CENTERTOWN

ITEM: TYPICAL PLAN AND PROFILE VIEW

STREAM: EPHEMERAL 28, 29, 36, Intermittent 4, 5

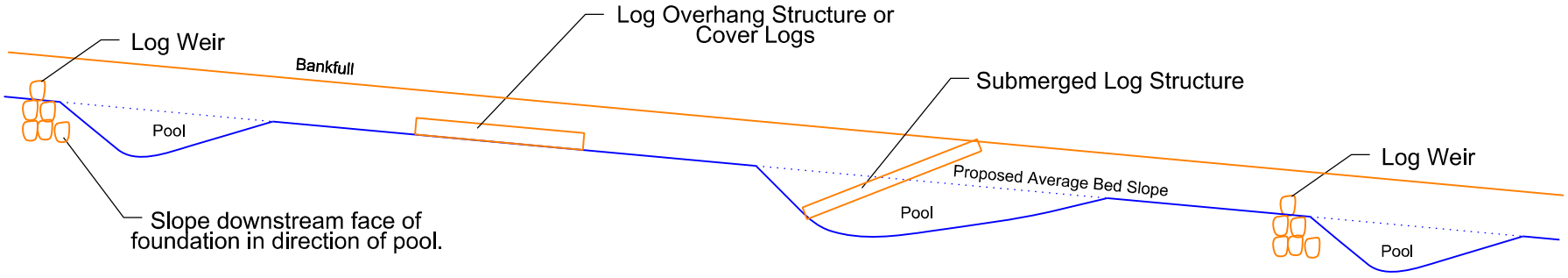
EXHIBIT 15

DATE:



Typical Plan View
Ephemeral / Intermittent "B" & "Ba" Stream Types

Max pool depths to be 1' to 2'.



Note: Meander Length may vary. Generally place a Log Weir every 150'-250' along the stream reach at the beginning of a bend in the stream.

Foundation logs below the exposed weir log shall extend below the constructed stream bed to at or below the anticipated scour depth (approximately 5').

Typical Profile View
Ephemeral / Intermittent "B" & "Ba" Stream Types

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

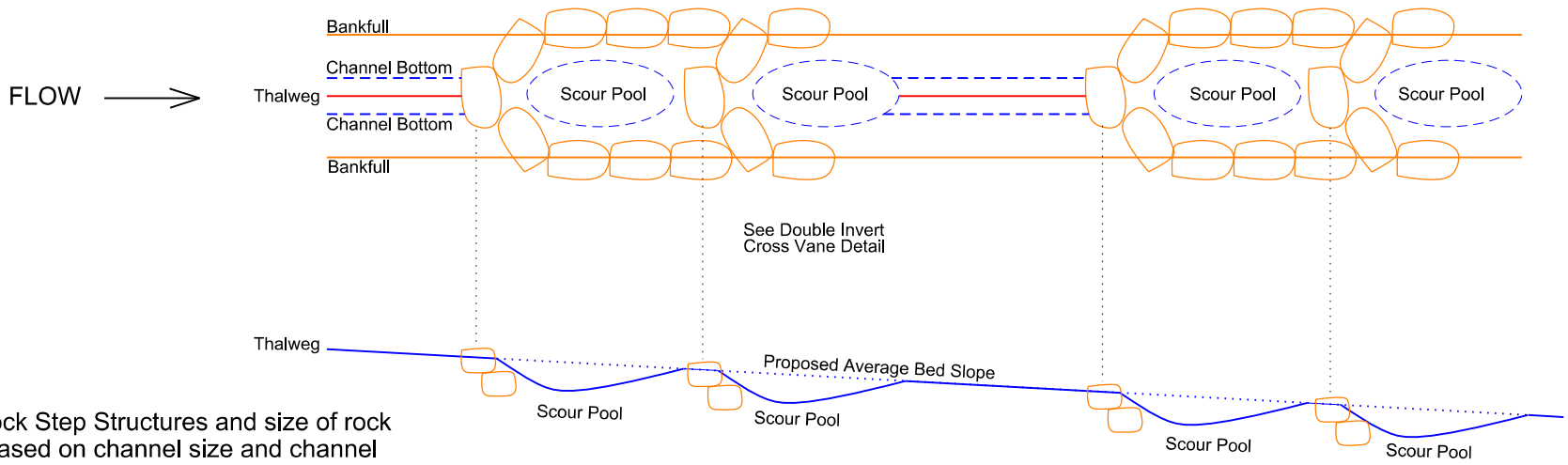
ITEM: TYPICAL PLAN AND PROFILE VIEW

STREAM: EPHEMERAL 28, 29, 36, INTERMITTENT 4, 5

EXHIBIT 16

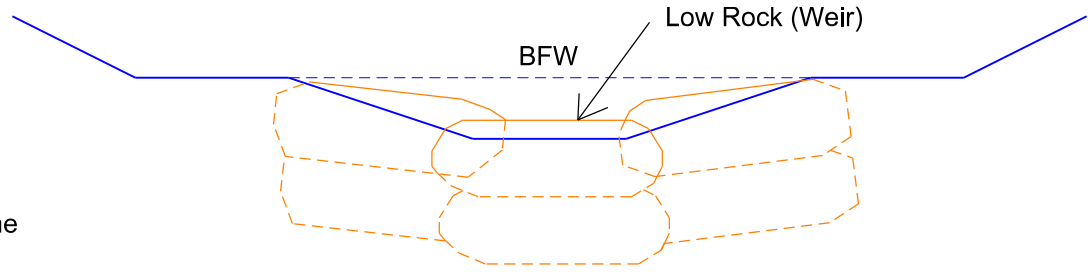
DATE:

Typical Plan View
Rock Step Structure
Alternate Ephemeral / Intermittent "B" & "Ba" Stream Types



Spacing of Rock Step Structures and size of rock used will be based on channel size and channel slope. These structures will be used on Intermittent or Ephemeral "B" & "Ba" Stream Types.

Typical Profile
Step-Pool Channel
Ephemeral / Intermittent "B" & "Ba" Stream Types



Typical Section of Rock Step Structure

Pools are to be excavated just downstream of low rock (weir). Pool depths will vary from 0.5 foot to 1.0 foot.

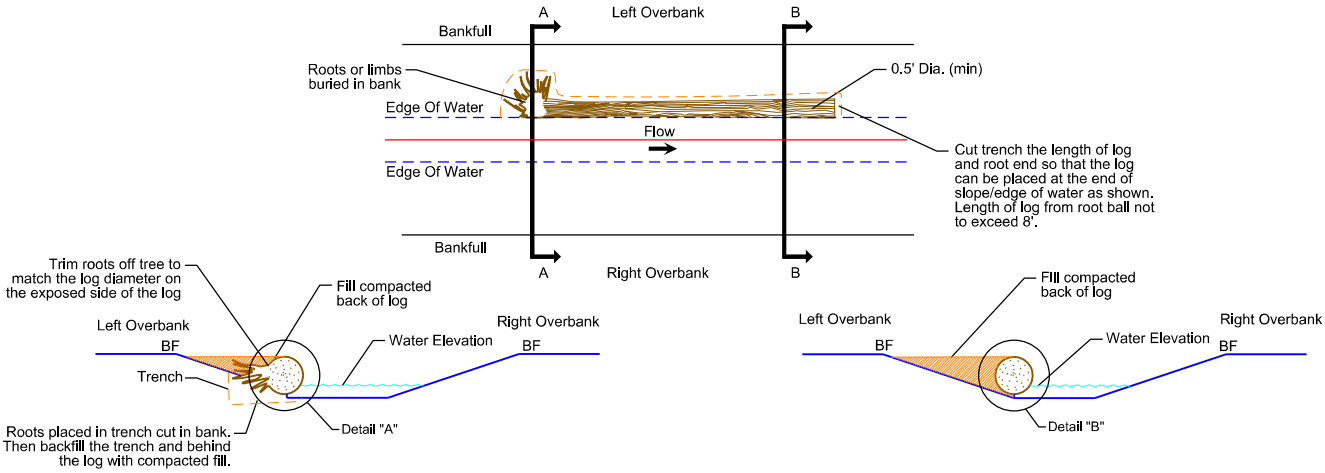
When rock is not available, logs spanning the stream bottom and buried into the banks at least ½ the bankfull stream width can be substituted. Top of the logs need to be placed so that they are level with the bankfull elevation and a notch cut out to form a weir at least ½ the bank full depth and running ⅓ of the length of the bankfull width. Logs should be buried below the stream bottom to prevent scour.

Foundation rock or logs if substituted shall extend below the constructed stream bed to at or below the anticipated scour depth (approximately 5').

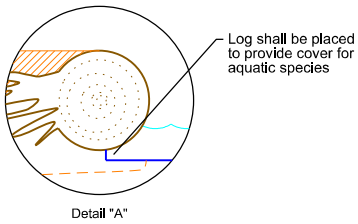
Habitat Structure Details

Ephemeral / Intermittent "B" & "Ba" Type Streams

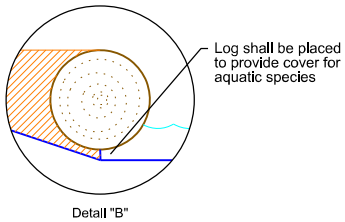
Log Overhang Structure



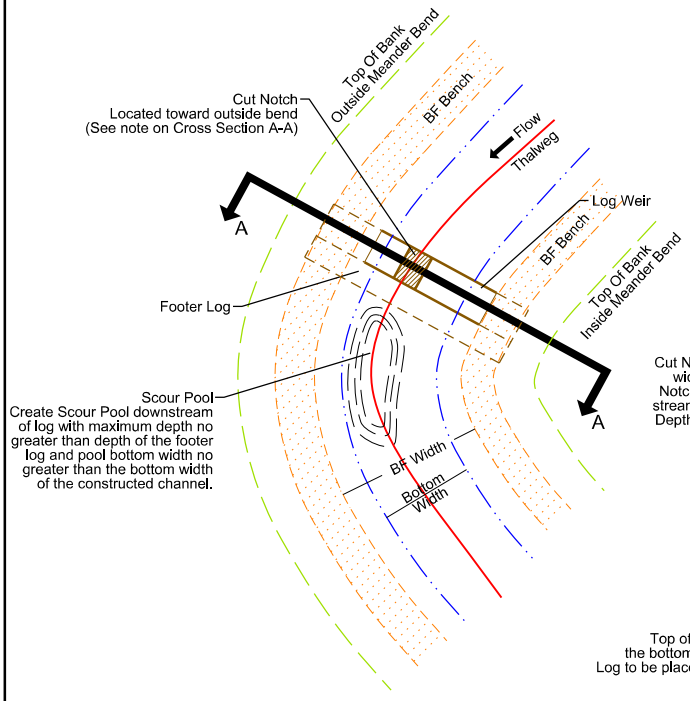
Section A-A



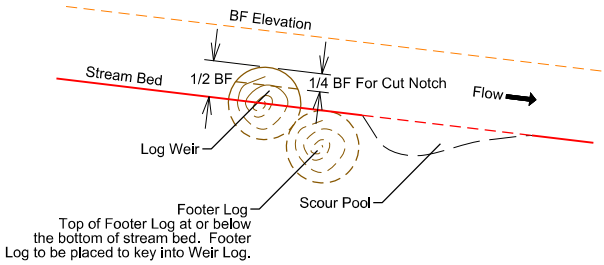
Section B-B



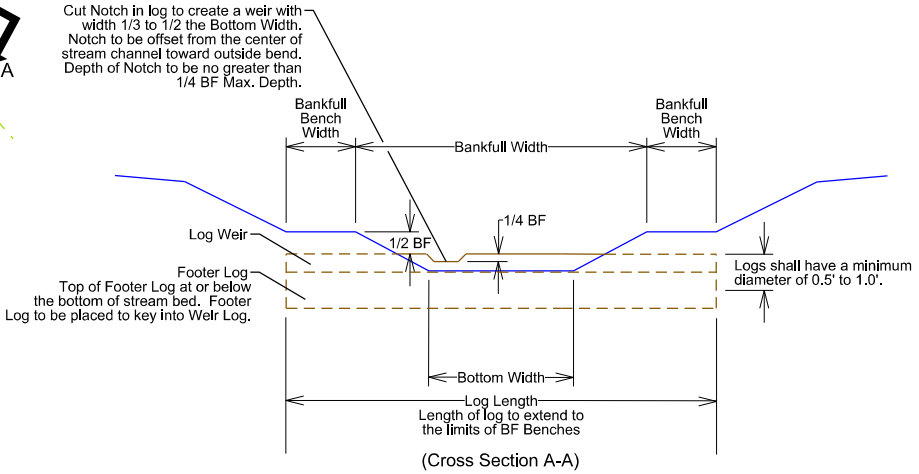
Log Weir



(Plan View)
Bankfull (BF)



(Profile)
Bankfull (BF)



(Cross Section A-A)
Bankfull (BF)

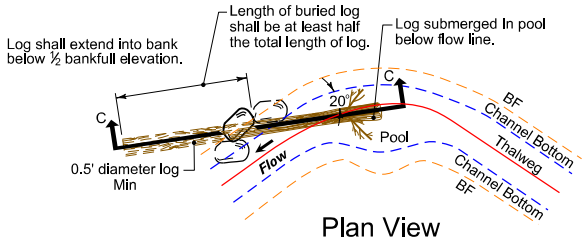
T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION			STREAM: EPHEMERAL 28, 29, 36, INTERMITTENT 4, 5	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: HABITAT STRUCTURE DETAILS	EXHIBIT 17

DATE:

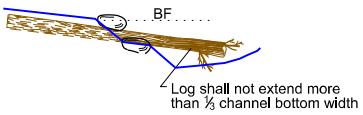
Habitat Structure Details

Ephemeral / Intermittent "B" & "Ba" Type Streams

Submerged Log Structure

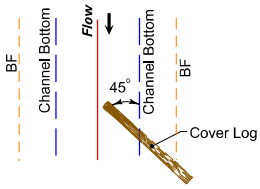


Plan View

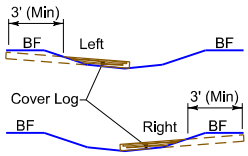


Section C-C

Cover Log



Plan View

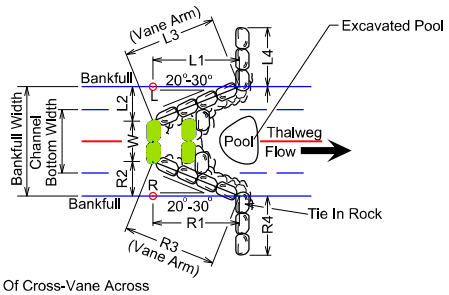


Cross Section View

Cover log shall consist of a 0.5' to 1.0' diameter log placed flush on channel bottom. One end of log will extend a minimum of 3.0' into channel bank and other end will extend to ¼ to⅓ channel bottom width. The log shall be angled in upstream direction.

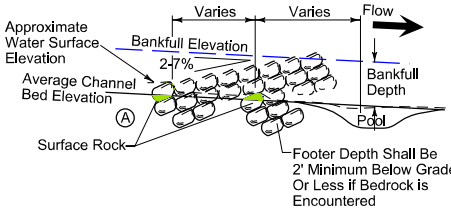
Log will alternate sides. (See Plan Sheets)

Double Invert Cross Vane



Top Of Cross-Vane Across Width (W) Is Level. Surface Rock In This Level (Upstream) Portion Is 0.5' (Maximum) Above Thalweg Of Channel.

(Plan View)



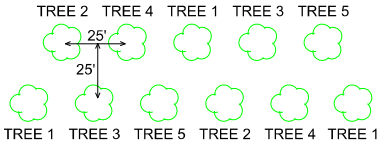
(Profile)

T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION			STREAM: EPHEMERAL 28, 29, 36, INTERMITTENT 4, 5	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: HABITAT STRUCTURE DETAILS	EXHIBIT 18

DATE:

RIPARIAN ZONE PLANTING NOTES
(USE OPTION ONE OR OPTION TWO FOR TREE PLANTINGS)

PLAN VIEW: PLANTING DETAIL
RPM Riparian Trees (Option One)



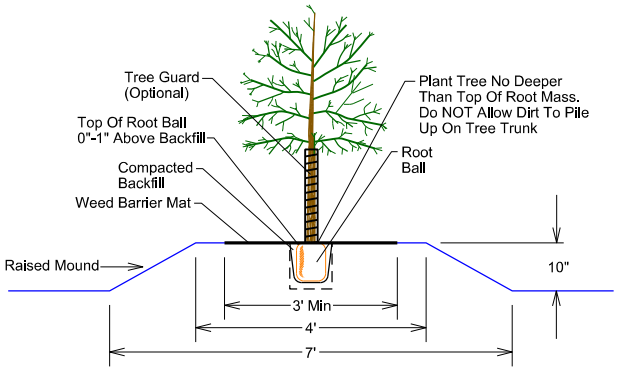
RPM RIPARIAN TREE PLANTINGS (OPTION ONE)

1. Only trees that have been produced by the Root Production Method (RPM) shall be planted in the Riparian zone.
2. The trees shall be three gallon container grown.
3. The trees shall be planted between the dates of October 1 and December 15.
4. Trees in the same row shall be planted on 25 foot spacing.
5. ✱ The first row of trees nearest the channel shall be planted approximately 8 feet beyond the shrub plantings.
6. The second row shall be planted 25 feet behind the first row. The subsequent rows will also be on 25 foot spacing.
7. The trees shall be planted in a staggered pattern, not one directly behind the other.
8. ✱ The trees shall be planted with alternating species.

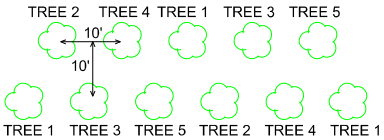
RECOMMENDED PROCEDURES FOR PLANTING RPM TREES

1. Site preparation - trees are to be planted on a raised mound of existing soil. The mound shall be 8-10 inches high after mild compaction. The base of the mound shall have a minimum width of seven feet with a flat crown (top) at approximately four feet.
2. The hole shall be approximately the same size as the container (10 inch diameter-8 inch depth).
3. ✱ After unloading trees, they shall be watered thoroughly and protected from excessive heat or cold. Do not allow rootball to freeze or dry out.
4. ✱ If the trees are not to be planted for several days or weeks, they should be watered every 3-4 days and again immediately before planting.
5. ✱ Remove the plastic container in which the trees have been growing prior to planting. Do not disturb rootball after container has been removed.
6. ✱ Do not plant trees any deeper than the level at which they were growing in the container. It is acceptable to plant the trees 1 inch above the level they were growing in the container.
7. Trees planted between October 1 and December 15, will require the application of a slow release fertilizer after planting. 1-1 1/2 tablespoons around drip zone is recommended. An analysis of 27-3-7 with I.B.D.U. or similar is recommended.

RPM TREE PLANTING DETAIL



PLAN VIEW: PLANTING DETAIL
NON - RPM Riparian Trees (Option Two)



TREE PLANTING (OPTION TWO)

1. Trees shall be container grown or bare root.
2. Bare root stock must be a minimum 30" (Inches) in height and planted on 10' x 10' spacing in a staggered pattern.
3. Three-gallon trees shall be planted on 19' x 19' spacing in a staggered pattern.
4. NOTE: Option One notes with ✱ also apply to Option Two

THE FOLLOWING TREES WILL BE USED FOR BOTH OPTIONS

An equal amount of the following trees are to be planted throughout the riparian zone.

INTERMITTENT STREAM TREE LIST

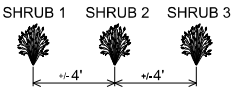
Tree 1: Shellbark hickory (Carya laciniosa)
Tree 2: Cherrybark oak (Quercus pagoda)
Tree 3: Willow oak (Quercus phellos)
Tree 4: Water oak (Quercus nigra)
Tree 5: White oak (Quercus alba)

EPHEMERAL STREAM TREE LIST

Tree 1: Shagbark hickory (Carya glabra)
Tree 2: American beech (Fagus grandifolia)
Tree 3: Shingle oak (Quercus imbricaria)
Tree 4: Post oak (Quercus stellata)
Tree 5: Shumard oak (Quercus shumardii)

SHRUB PLANTINGS
(These will not be RPM Plantings)

PLAN VIEW: SHRUB PLANTING DETAIL



The following shrubs are to be planted near bankfull elevation. See typical cross sections for number of rows and placement.

Shrub 1: Rough-leaf Dogwood (Cornus drummondii)
Shrub 2: Strawberry Bush (Euonymus americanus)
Shrub 3: Indigo Bush (Amorpha fruiticosa)

Three gallon container shrubs shall be planted on approximate 4' spacing with an equal amount of each species planted in random sequence.

SEEDING:

The following native grasses will be sown along both stream banks and throughout the riparian zone:

Switchgrass (Panicum virgatum)	20%
Virginia Wild Rye (Elymus virginicus)	20%
Rough Barnyard Grass (Echinochloa muricata)	10%
Annual Rye (Lolium perenne)	10%
Big bluestream (Andropogon gerardii)	20%
Forking panic grass/smooth panic grass (Dichanthelium dichotomum/ dichotomiflorum)	20%

Apply seed at a rate of 20 pounds/acre or as recommended by seed supplier.

Straw mulch or erosion control blanket shall be placed immediately following seeding.

Additional native species may be substituted based on approval of Army Corps of Engineers

Riparian Zone Width will be a minimum of 100' for intermittent streams

Shrub plantings and seeding will be the same for each option.

T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE MINE SITE - PROPOSED ON-SITE MITIGATION				
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: PLANTING NOTES	EXHIBIT 19

DATE:

Streams To Be Mitigated On Site
Warden Waste

Stream	Impact Stream Length (ft)	Proposed Stream Stream Length (ft)
EPH-28	794	994
EPH-29	826	992
EPH-30	156	147
EPH-31	168	174
EPH-32	197	252
EPH-33	219	264
EPH-34	283	228
EPH-35	232	338
EPH-36	654	784
INT-4	1794	2100
INT-5	923	875
	MITIGATION TOTALS: Ephemeral = 4173 ft. Intermittent = 2975 ft.	

T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION			STREAM: UT'S TO ELK CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: STREAM LENGTHS	EXHIBIT 20

DATE:

C. Compensatory Mitigation: Warden Waste Site

Off-Site Mitigation

(1) Goals and Objectives

Off-site streams with low Rapid Bio-assessment Protocol (RBP) scores will be restored in order to increase their functions and provide an ecological "lift" over existing conditions. Streams with sufficiently high RBP scores are to be preserved. All efforts will serve to provide credit towards on-site impacts. The goal of stream mitigation is to provide in-stream habitat and to construct stable stream systems that convey the bankfull discharge and sediment supplied by the watershed. For the off-site restoration streams, the ecological "lift" will result from addressing bank erosion, installing in-stream habitat structures, and raising the water level to re-establish floodprone areas and promote overbank flooding where streams are currently incised. Streams with RBP scores in the poor and marginal range (i.e., scores from 0 to 100) will be given priority for these opportunities. Preservation of other streams will be based on a current assessment that indicates at least a suboptimal quality score (i.e., an RBP score between 101 and 150). One ephemeral stream (E-37) will be preserved but "plugged" at a downstream point to promote retention of water to aid in the creation of wetlands near existing Wetland E. In addition, several swales near existing and created wetlands will be diked for the same retention purpose. Mitigation for wetland impacts will be done in conjunction with restoration efforts for Williams Creek and its tributaries. Wetland creation will primarily involve expanding existing wetlands by inducing more overbank flooding and by planting for a palustrine forested wetland. Enhanced wetlands will be those existing wetlands that will be preserved and expanded through the creation efforts, and have palustrine forested species planted to replace upland species harvested for use in the stream restoration efforts. The goal will be to have 22 acres of palustrine forested wetland (PFO) through preservation, enhancement, and creation efforts (approximately 4 acres preserved, another 8 acres will be preserved/enhanced, and 10 acres created).

(2) Site Selection

Site selection for those streams to be mitigated off-site was based on the principal of enhancing impaired existing aquatic resources and preserving other resources; all within the same major watershed affected by proposed project impacts. The off-site mitigation will be located immediately adjacent and downstream of the project site. The most practical way to improve existing stream functions and contribute to the aquatic resource needs of the watershed is to enhance and/or preserve existing stream systems and drainage networks that are similar to, or

better than, their existing conditions. The off-site area is also an ideal area for restoration/enhancement/preservation opportunities since the site has never been mined, having more natural channel substrates and groundwater conditions.

(3) Baseline Information

(a) Wetland mitigation and additional stream mitigation will be performed off-site; focusing on the restoration of perennial streams and preservation of intermittent and ephemeral streams. Wetlands will be created in conjunction with stream mitigation activities and result in expanding the footprint of several of the existing wetlands that are to be preserved/enhanced. Other existing wetland areas are to be preserved in their current state. No excavation or fill work is expected for wetland creation. All resources within the off-site mitigation area were assessed separately from the original baseline assessment work; the resulting data sheets (along with photographic documentation) are included with this section of the mitigation plan as an appendix. The lowest RBP scores found during the investigations were for the two perennial streams P-1 (Williams Creek) and P-2 (a Williams Creek tributary also indicated as the Kronos Tributary). These perennials have multiple assessments due to their lengths, allowing for better identification of the existing conditions on which to base opportunities for enhancement, preservation, or a combination. However, due to the low scores all along their lengths, both P-1 and P-2 warrant full restoration. It should be noted that portions of the downstream reaches of P-1 and P-2 lie outside the mitigation site on state roadway right-of-way and will remain undisturbed and not counted for mitigation credit. All other streams yielded RPB scores in the suboptimal range, with many in the middle of the suboptimal range. Two of the lowest scores were for intermittent I-7 and ephemeral E-42 (108 and 109, respectively). Intermittent I-7 lies mostly within existing roadway right-of-way, eliminating any meaningful opportunity for enhancement or restoration. For purposes of the mitigation plan I-7 will be left undisturbed, with limited preservation credit requested. Although E-42 has a low score, it has valuable as the outlet channel for a wetland and should be preserved. It is proposed that all intermittent and ephemeral streams (within the project area and outside roadway right-of-way limits) be preserved. See Table 1 for the RBP scores for all streams and/or stream reaches found on the mitigation site.

(b) The proposed off-site mitigation will involve the enhancement of 6,693 feet of perennial stream, as well as the preservation of 3,429 feet of intermittent and 3,848 feet of ephemeral stream. In addition, at least 10 acres of palustrine forest wetlands will be created in conjunction with stream mitigation activities, while approximately 12 acres of existing wetlands will be preserved and/or enhanced. See Table 2 for a list of all project mitigation proposed.

(c) The aquatic resource type includes ephemeral, intermittent, and perennial streams and forested wetlands.

(d) Off-site streams and wetlands were evaluated separately. Their assessment sheets/photographs are included with this section of the mitigation plan. The off-site site is located within the same two twelve-digit Hydrologic Unit Codes (HUC's) as the on-site mitigation area; the Elk Creek-Green River (051100030505) and Nelson Creek-Green River (051100030504).

(4) Mitigation Work Plan

(a) Boundaries of the proposed mitigation site are provided in the exhibits.

(b)The off-site stream and wetland mitigation work will be performed during the development of the waste disposal to reduce temporal loss.

Off-site stream/wetland construction sequence will be as follows:

1. Perform minor excavation of stream banks to establish floodprone widths at bankfull elevations; while limiting disturbance of existing riparian vegetation
2. Install bank toe protection where appropriate
3. Install in-stream structures, including those to raise water surfaces for wetland creation.
4. Prepare streambanks for seeding
5. Install erosion control blanket as needed.
6. Plant USACE approved trees and shrubs along streams and proposed wetland areas.

(c) The proposed off-site streams retain their current patterns and connectivity; existing wetlands will remain undisturbed.

(d) For off-site stream restoration, where needed due to construction, and any of the preserved streams that may have some limited disturbance from the restoration construction activities, the native vegetation to be planted along stream banks and riparian zones include the following species or species available at the time of ordering and approved by USACE (the same species to be utilized for the on-site mitigation effort):

Grasses - Virginia wild rye (*Elymus virginicus*), Switchgrass (*Panicum virgatum*), Rough barnyard grass (*Echinochloa muricata*), Big bluestem *(Andropogon gerardii)*, Forking panic grass/smooth panic grass *(Dichanthelium dichotomum/dichotomiflorum)* and Annual rye (*Lolium perenne*).

Shrubs – Rough-leaf dogwood (*Cornus drummondii*), Strawberry bush (*Euonymus americanus*), and Indigo-bush (*Amorpha fruticosa*). Shrubs will be 3-gallon container grown, planted on a four foot spacing along the streambanks at the bankfull elevation where needed to aid in bank stabilization.

Trees – For the perennial streams and any intermittent stream that may require some replanting: Shellbark hickory (*Carya laciniosa*), Willow oak (*Quercus phellos*), Cherrybark oak (*Quercus pagoda*), Water oak *(Quercus nigra)*, and White oak (*Quercus alba*). For any ephemeral stream that may require some replanting: Shagbark hickory *(Carya glabra)*, American beech *(Fagus grandifolia)*, Shingle oak *(Quercus imbricaria)*, Post oak *(Quercus stellata)*, and Shumard oak *(Quercus shumardii).* Trees will be either 3-gallon container grown RPM planted at a rate of 60 trees per acre, or 3-gallon non-RPM planted at a rate of 120 trees per acre, or non-RPM bare root seedlings (minimum of 30 inches in height) planted at a rate of 450 stems per acre. The option utilized will be dependent on plant availability at the time of mitigation planting (if plant availability is not an issue, more than one option may be utilized to compare survival rates for future mitigation projects). In addition, a single row of shrubs will be planted along edge of stream just above bankfull elevation where needed to aid in bank stabilization. Shrub spacing will be approximately four feet on average with higher densities at high shear locations (ex. outside bends).

For off-site wetland creation the native vegetation to be planted for establishing at least 10 additional acres of palustrine forested wetland include the following species (wetland enhancement areas will use the same species as well):

Trees – Shellbark hickory (*Carya laciniosa*), Pin oak (*Quercus palustris*), Cherrybark oak (*Quercus pagoda*), Swamp white oak *(Quercus bicolor)*, Willow oak *(Quercus phellos)*, and Baldcypress (*Taxodium distichum*).

Herbaceous seed mix – a mix, such as Cardno JFNew's "Wooded Wetland Establishment" is suggested. As an alternative, the following species list shall be used (other appropriate species may be substituted as cost and availability allows and as approved by the USACE): Green bulrush *(Scirpus atrovirens),* Virginia wild rye *(Elymus virginicus),* Fox sedge *(Carex vulpinoidea)*, Soft rush *(Juncus effusus)*, Woolgrass *(Scirpus cyperinus)*, and Common sneezeweed *(Helenium autumnate).*

Per Kentucky Division of Mine Permits (KDMP) requirements: planting of woody species will occur during first dormant season following stream restoration.

(e) Any vegetation that would hinder planting or provide excessive competition to natural regeneration of planted species will be removed with appropriate treatment and documented in each annual monitoring report.

(f) Exotic vegetation control: The following efforts will be made to reduce introduction and dispersal of invasive species: removal of exotic species before mitigation begins, cleaning equipment before it reaches the site, inspecting labels on seed mixtures and mulch for composition and vegetative monitoring during the required monitoring period. Volunteers,

invasives, and/or exotic vegetation along riparian zones or within created wetland areas will be removed by mowing, digging, spraying, burning or a combination of these during annual maintenance; and documented in each annual monitoring report.

(g) Proposed mitigation plan sheets provide elevation and slope details for the restored stream designs, and details on specific enhancement efforts and wetland creation.

(h) Erosion control methods will consist of the following: enhancing stream channels during low or no flow periods, applying seed and installing erosion control blanket immediately after final grading, planting trees and shrubs and installing silt fence as needed. Stream enhancement will proceed in a downstream direction to avoid re-suspension of sediment.

(i) Proposed stream enhancement designs are based on geomorphic and hydrologic principles incorporated with natural channel design techniques utilizing in-stream structures for habitat diversity and stream bank protection. Wetland creation designs will be incorporated into stream enhancement designs.

(j) Proposed Stream Plans will indicate stream type, pattern, profile and dimensions for each stream. Stream morphology was determined by using regional curve data, collecting and studying data from the existing streams, sediment transport and hydrologic calculations, and experience designing and constructing streams.

(k) Natural channel design methods, in-stream structures, and habitat enhancement features will be incorporated into the mitigation plan. Habitat enhancement features will consist of cover logs, log overhangs, submerged logs, and log/rock vane structures. These features will also provide bank stability while vegetation becomes established. Stream enhancement efforts will also include the installation of grade control structures to raise incised streambeds in order to promote reconnection to the floodplain. This effort will also allow for establishment of wetlands in the floodplain of those streams.

(l) Mitigation sites will be permanently protected and maintenance will be provided as needed, throughout the monitoring period. Site protection will be provided through use of a restrictive covenant. Maintenance will include elimination of volunteer species by use of general or spot applications of herbicides, hand picking and mowing, where appropriate.

(m) A representative from the design team will be on site during critical phases of the construction process. The representative will make periodic site visits and will familiarize construction personnel with design plans and restoration methods.

(5) Performance Standards/Success Criteria

(a) Standards for assessing **stream restoration mitigation** goals include:

1. Streams to be restored on-site must be constructed to meet the dimension, pattern and profile of the indicated Rosgen Stream Type.
2. There should be no signs of excessive stream bank erosion or severe headcutting.
3. At the end of the monitoring period, the streams shall have average riffle cross section dimensions reflective of the indicated Rosgen Stream Type.
4. At the end of the monitoring period, the restored off-site streams shall have minimum EPA Rapid Bioassessment Protocol scores in the sub-optimal range. The target RBP scores are as follows: P-1 (upstream to downstream by assessment reach) = 110, 110, 120, 120; and P-2 = 120.
5. Root Production Method (RPM) trees will be planted at a rate of 60 trees per acre, or non-RPM 3-gallon container grown will be planted at a rate of 120 trees per acre, or bare root seedlings (minimum height of 30 inches) will be planted at a rate of 450 trees per acre. The option utilized will be dependent on plant availability at the time of mitigation planting (if plant availability is not an issue, more than one option may be utilized to compare survival rates for future mitigation projects).
6. Riparian vegetation shall have at least an 80% survival rate of the initial planting of non-RPM 3-gallon container grown or bare root seedlings; with no single planted tree species constituting more than 25 percent of the surviving species. The survival rate for RPM plantings is 90 percent. No one species shall comprise more than 25 percent of the surviving RPM plantings.
7. Riparian vegetation will consist of no volunteer tree species at the end of the monitoring period.
8. Per Kentucky Division of Mine Permits (KDMP) requirements: one measure of project success will be final stream assessment scores that equal or exceed pre-project scores.
9. In the riparian areas, herbaceous plantings must provide a minimum of 70 percent ground cover; with no one species accounting for more than 40 percent ground cover.
10. Streams will retain their existing linear footage and flow regime.
11. Streams will have a new Ordinary High Water Mark for sections resulting from constructed riffle structures.
12. Stream channel and in-stream structures must be stable and functioning as designed.
13. Stream morphology must meet proposed Rogsen classifications (i.e., stream slope, sinuosity, belt width, meanders, bankfull cross-sectional area, width/depth ratios).
14. Annual monitoring should indicate that mitigation is progressing toward meeting success criteria.

(a) Standards for assessing **wetland creation mitigation** goals include:

1. Success will be based on the USACE 2009 Draft Interim Regional Supplement to the Corps of Engineers' Wetland Delineation Manual: Eastern Mountains and Piedmont Region.

2. Riparian vegetation shall have at least an 80% survival rate of the initial planting of non-RPM 3-gallon container grown or bare root seedlings; with no single planted tree species constituting more than 25 percent of the surviving species. The survival rate for RPM plantings is 90 percent. No one species shall comprise more than 25 percent of the surviving RPM plantings. Herbaceous plantings must provide a minimum of 70 percent ground cover with no one species accounting for more than 40 percent of ground cover.

3. The wetland will meet the proposed Cowardin Classification (PFO) at the end of the monitoring period.

4. At least 10 acres of created wetlands will develop in order to fully meet mitigation requirements.

5. Wetland hydrology will be achieved through the measurement of 14 or more consecutive days of flooding or ponding, or a water table 12 inches or less below the soil surface, during the growing season at a minimum frequency of 5 years in 10, as stated in the USACE Regional Supplement[1].

6. Three hydrogeomorphic (HGM) variables will be measured during biannual monitoring to assess the restoration of wetland functions. Water table fluctuation, redoximorphic features, and ground vegetation biomass will be measured per the regional HGM guidebook[2]. These variables will determine the wetland's ability to maintain a characteristic plant community, remove and sequester elements and compounds, and cycle nutrients.

(b) Adaptive Management

If success criteria are not met during the monitoring period, an analysis of the contributing conditions will be conducted and documented. Remedial action, if required by USACE, will be performed and documented by the applicant. Remedial actions may include replanting trees and shrubs, reseeding grasses, adjusting in-stream structures and repairing eroded banks. These actions will be performed at least twice, depending on the nature of the problem. Should these efforts not resolve the issue, another site will be found to replace failed sections of the mitigation sites. The contingency plan for proposed restored perennial streams and created wetlands will

[1] U.S. Army Corps of Engineers. 2010. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, ed. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-10-XX. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

[2] Ainslie, W. B., Smith, R. D., Pruitt, B. A., Roberts, T. H., Sparks, E. J., West, L., Godshalk, G. L., and Miller, M. V. (1999). "A regional guidebook for assessing the functions of low gradient, riverine wetlands in western Kentucky," Technical Report WRP-DE-17, U. S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

be payment of in-lieu fees. For the perennial streams, contingency payment will be based on the length of stream that does not meet performance standards/success criteria during the monitoring period. For wetlands, it is based on the acreage of wetland that does not meet performance standards.

(c) Project Performance Evaluations

All stream and wetland sites will be monitored in accordance with the Mitigation Final Rule, 2008. In general, the following guidelines will be used:

For restoration streams:

1. The monitoring period must be sufficient to demonstrate that the compensatory mitigation has met performance standards. The monitoring period length shall be a minimum of five years unless performance standards are met in less than five years. In this case, the monitoring period length can be reduced if there are at least two consecutive monitoring reports that demonstrate that performance standards have been met. Longer monitoring timeframes are necessary for compensatory mitigation projects that take longer to develop.
2. Biannual inspections will be conducted each year during the first and last month of the growing season.
3. The first monitoring report will be due after the first full growing season following the initial planting.
4. Monitoring reports are due to USACE by January 31 for the previous year, and to the Kentucky Division of Mine Permits (KDMP) by December 31 for the same monitoring year.
5. Photo stations and monitoring stations will be at the same location.
6. Permanent photo/monitoring stations will be set at a minimum of 1 per 500 feet of perennial stream.
7. The same monitoring stations shall be used every year.
8. Personnel familiar with natural stream design principles will perform monitoring tasks.
9. Stream monitoring will consist of assessing stream parameters and documenting vegetation survival.
10. Stream channel form and in-stream structure stability will be monitored to ensure stream functionality. Maintenance will be performed if the following conditions develop: excessive bank erosion occurs (RBP scores in the marginal range for bank stability), erosion around or under structures that would render them ineffective or cause structure collapse, excessive siltation of pools reducing their effectiveness in reducing energy and/or adversely affecting pool habitat, and upstream directed vertical bed erosion (headcut) that would jeopardize structure stability and lead to unstable channel conditions (RBP scores in marginal range for epifaunal/substrate cover or sediment deposition). Stream conditions will be inspected frequently by design and/or

stream construction team. Stream channel maintenance will be performed as needed to ensure stream stability, function and value.

11. Monitoring reports will include a discussion of inspection findings. Conditions such as bank erosion, streambed characteristics and vegetation survival will be documented. Stream assessments will be conducted and RBP scores will be compared to pre-disturbance scores and previous monitoring scores to determine if mitigation is progressing towards meeting goals. Any problems will be identified and remedial action taken.

12. Parties responsible for monitoring will be Armstrong personnel familiar with the project and natural channel design, or USACE-approved consultants.

13. RBP assessments will be used to assess physical quality of stream and will include conductivity, pH and temperature readings. Monitoring reports will include photographic documentation of streams and riparian vegetation. In addition, riparian vegetation will be inspected and density, survivorship, composition, percent cover and any non-native species will be documented. Macroinvertebrate and fish surveys will be conducted, as required. The Kentucky Division of Water's "Methods for Sampling Benthic Macroinvertebrates Communities in Wadeable Waters" will be followed.

14. When petitioning the Corps for release of mitigation requirements, a full stream delineation for the mitigation site will be provided (e.g. linear footage, Rosgen, RBP, flow regimes, riffle/pool count, riparian vegetation survivability).

15. With the first annual report, as-built drawings for the enhanced stream mitigation will be provided.

16. Data collected at the permanent monitoring stations shall, at a minimum, include Rosgen analysis and RBP characterization/habitat measurements. Data will be recorded on appropriate documents.

17. Annual macroinvertebrate and fish sampling will commence the first full year after construction.

For created wetlands:

1. The monitoring period must be sufficient to demonstrate that the compensatory mitigation has met success criteria. The monitoring period length shall be 10 years; however, the applicant can petition for early release after 5 years if success is assured.

2. Biannual inspections will be conducted each year during the first and last two months of the growing season.

3. The first monitoring report will be due after the first full growing season following the initial planting.

4. Monitoring reports are due to USACE by January 31 for the previous year.

5. One permanent monitoring/photo station is typically required for every three acres of each wetland type created at each wetland location; in this case there are 4 distinct areas of creation, so a total of 4 photo stations will be used. A Regional Supplement wetland delineation form will be filled out at each station.

(6) Project Success

The applicant will be responsible for all mitigation including construction oversight, monitoring and reports, corrective measures, site access control and protection. The surface mining operation will obtain and submit to KDMP a certification from a registered professional engineer that all mitigation work has been completed in accordance with the conditions of the Water Quality Certification.

(7) Site Protection

Site protection will be provided through use of a restrictive covenant. The restrictive covenant will be executed after completion of the mitigation construction. It will be recorded within 60 days after mitigation construction completion, with USACE notification of recording at the time of execution. Durable signs will be placed identifying the mitigation site as an area not to be disturbed. They will be placed on approximately 500 foot intervals along the perimeter of the site. The mitigation site will be integrated into the reclamation plan, with limited site access.

(8) Contingency Plan

If success criteria are not met for any portion of the monitoring year and/or final success criteria are not satisfied, an analysis of the contributing conditions will be conducted and documented. Remedial action, if required by USACE, will be performed and documented by the applicant. Should these efforts not resolve the problem, the contingency plan for the proposed enhancement of perennial streams and created wetlands will be payment of in-lieu fees. For the perennial streams, contingency payment will be based on the length of stream that does not meet performance standards/success criteria during the monitoring period. For wetlands, it is based on the acreage of wetland that does not meet performance standards.

(9) Monitoring and Long-Term Management

(a) The applicant will be responsible for accomplishing, maintaining, and monitoring all mitigation sites. Long-term management will include a protective covenant.

(b) Monitoring plans will be provided as discussed under Performance Standards.

(10) Financial Assurances

The applicant will be responsible for managing any financial assurances and contingency funds set-aside for remedial measures. The USACE, Louisville District, currently does not have the means to handle financial assurances; therefore, no USACE-managed financial assurances are proposed for this project.

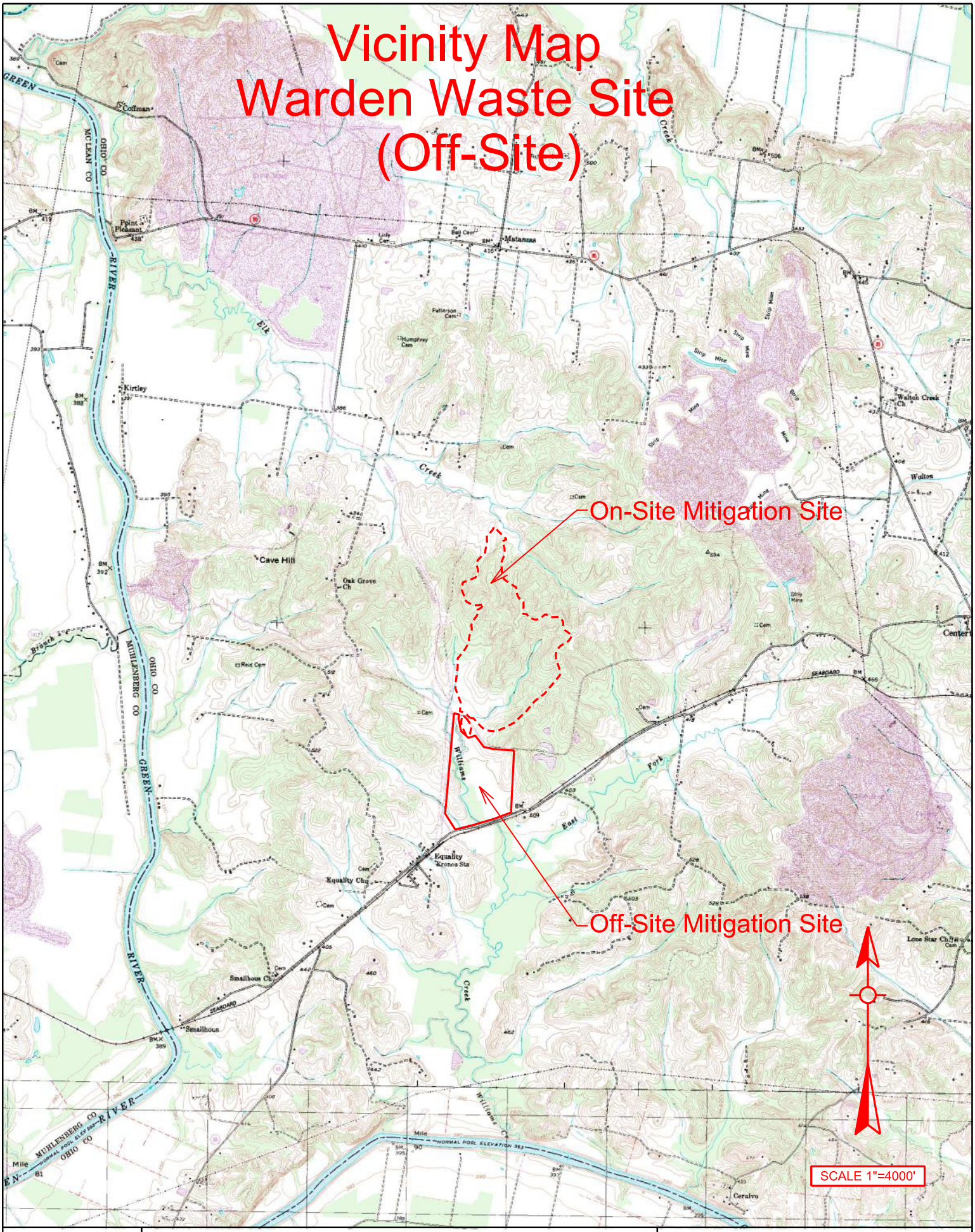
TABLE 1

Warden Waste Site
Existing Off-site Resources

Stream ID	Stream Type	Existing Length/Acres	RBP Scores*
OFF-SITE			
P-1	Perennial	5509	89/97/95/97
P-2	Perennial	1184	95/98
I-6	Intermittent	517	114
I-7	Intermittent	91	108
I-8	Intermittent	1626	125/121
I-9	Intermittent	1195	123
E-37	Ephemeral	253	132
E-38	Ephemeral	329	117
E-39	Ephemeral	1092	124
E-40	Ephemeral	752	130
E-41	Ephemeral	343	128
E-42	Ephemeral	387	109
E-43	Ephemeral	692	112
Wetland D	PFO	4.84 ac.	
Wetland E	PFO	1.19 ac.	
Wetland F	PFO	1.90 ac.	
Wetland G	PFO	0.68 ac.	
Wetland H	PFO	0.70 ac.	
Wetland I	PFO	1.24 ac.	
Wetland J	PFO	1.15 ac.	
TOTALS:	Perennial	6693 ft.	
	Intermittent	3429 ft.	
	Ephemeral	3848 ft.	
	Wetlands	11.70 ac.	

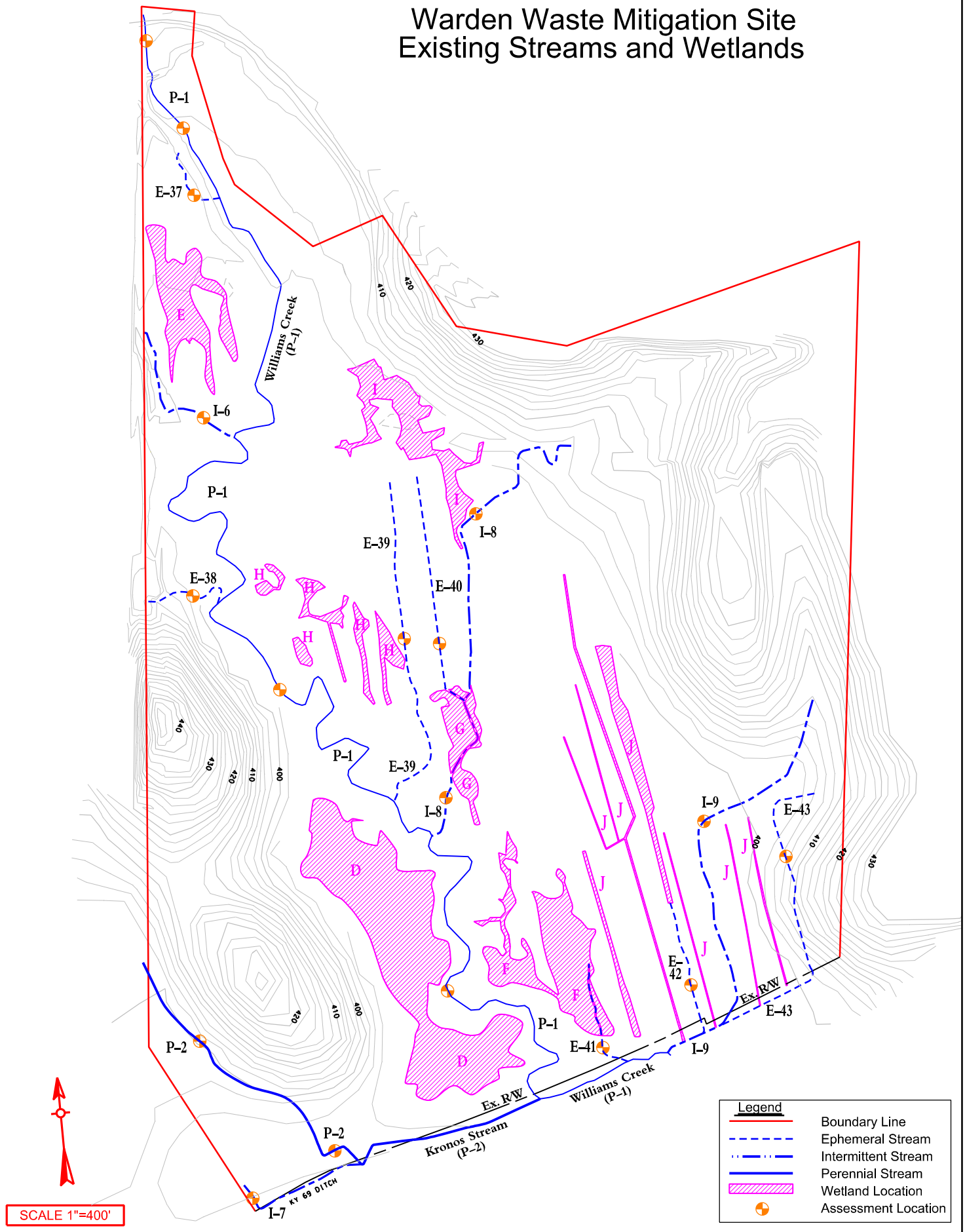
*Listed upstream to downstream for multiple assessments

Vicinity Map
Warden Waste Site
(Off-Site)



T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE - OFF-SITE MITIGATION LOCATION			STREAMS: UT's OF WILLIAMS CREEK & WILLIAMS CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: VICINITY MAP	EXHIBIT 21

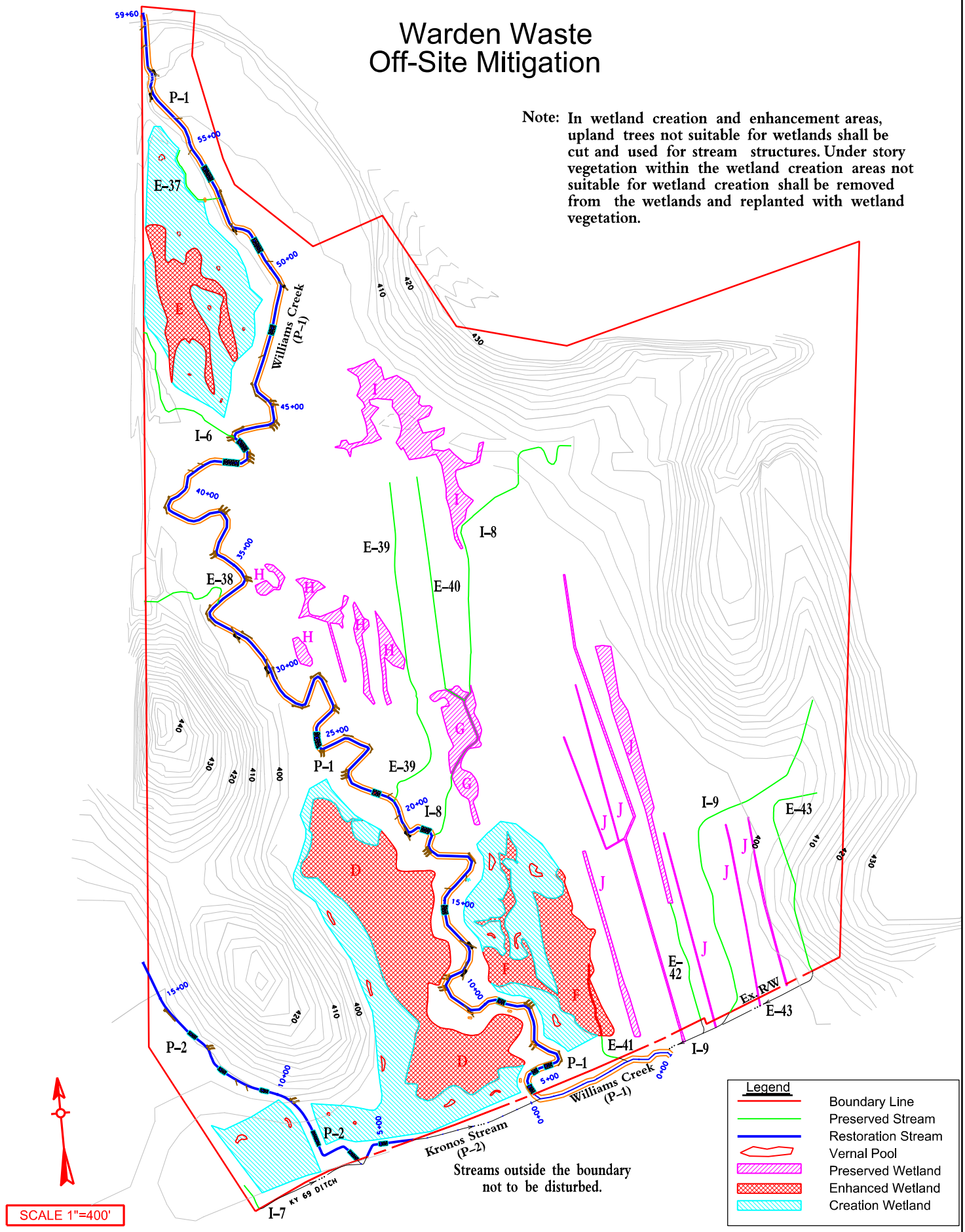
Warden Waste Mitigation Site
Existing Streams and Wetlands



T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE - JURISDICTIONAL WATERS DELINEATION			STREAMS: UT'S OF WILLIAMS CREEK & WILLIAMS CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: TOPO	EXHIBIT 22

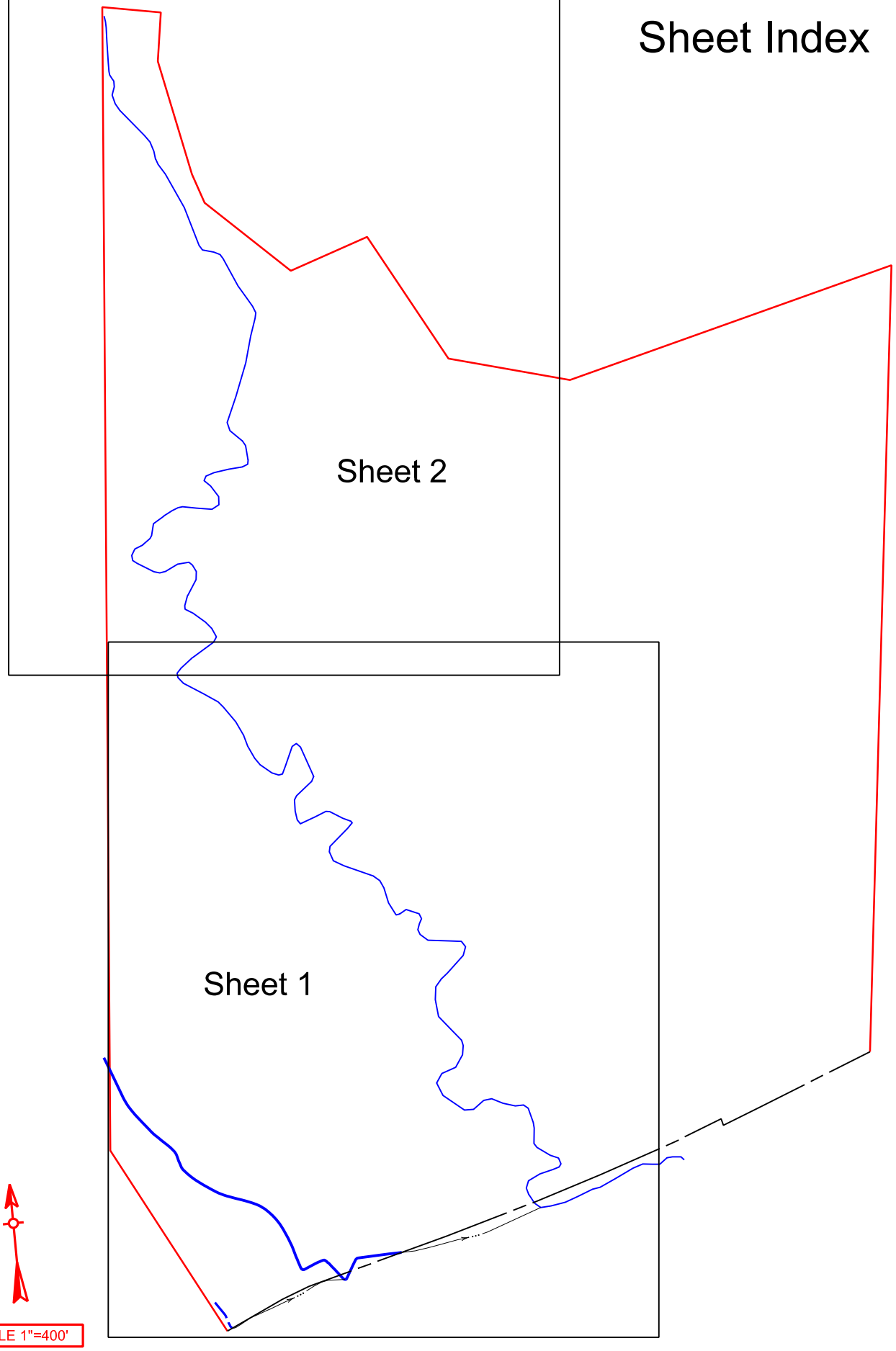
Warden Waste
Off-Site Mitigation

Note: In wetland creation and enhancement areas, upland trees not suitable for wetlands shall be cut and used for stream structures. Under story vegetation within the wetland creation areas not suitable for wetland creation shall be removed from the wetlands and replanted with wetland vegetation.



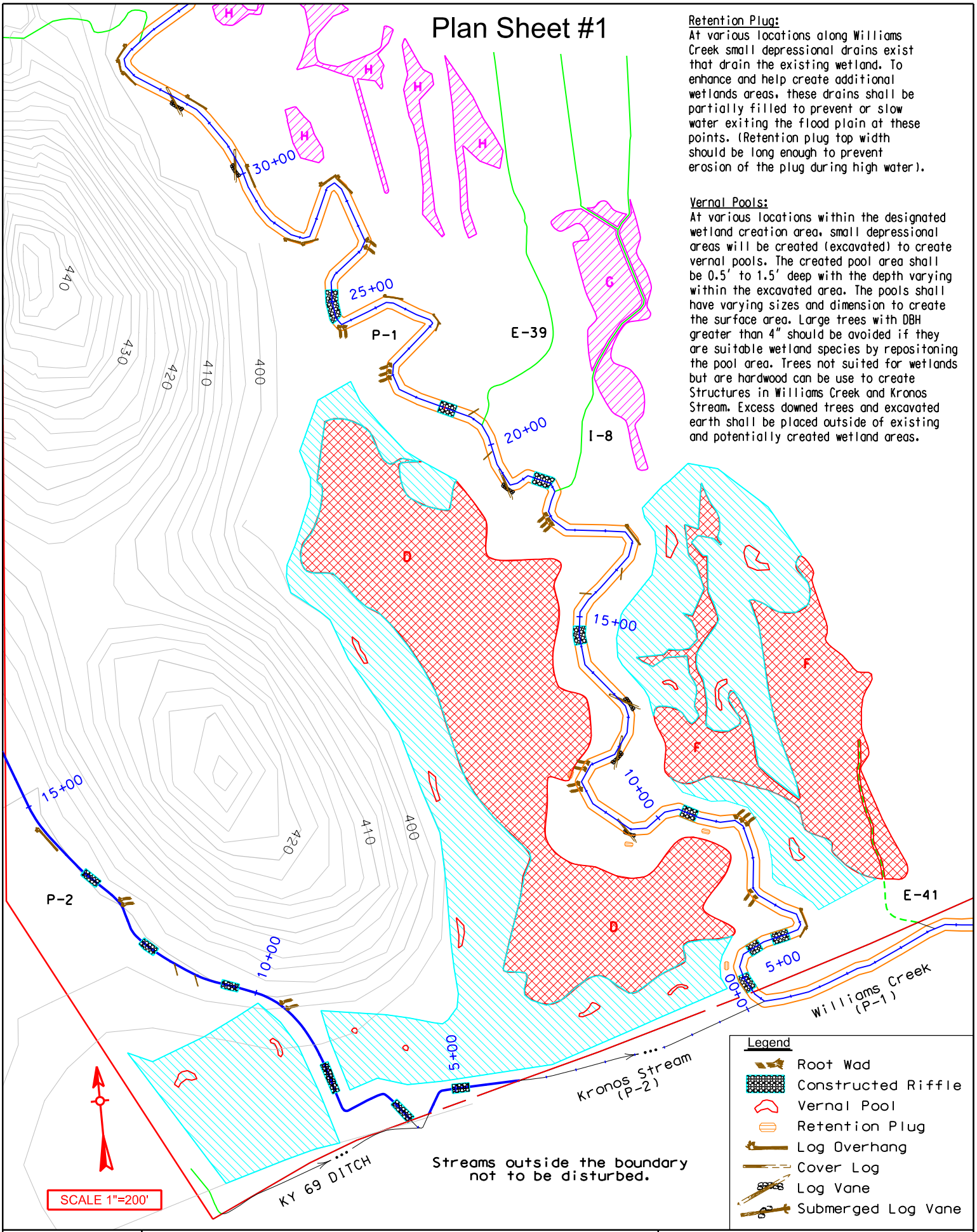
T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE - PRESERVATION, RESTORATION & CREATION			STREAMS: UT'S OF WILLIAMS CREEK & WILLIAMS CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: TOPO	EXHIBIT 23

Sheet Index



T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE - RESTORATION & PRESERVATION			STREAMS: UT'S OF WILLIAMS CREEK & WILLIAMS CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: INDEX MAP	EXHIBIT 24

Plan Sheet #1

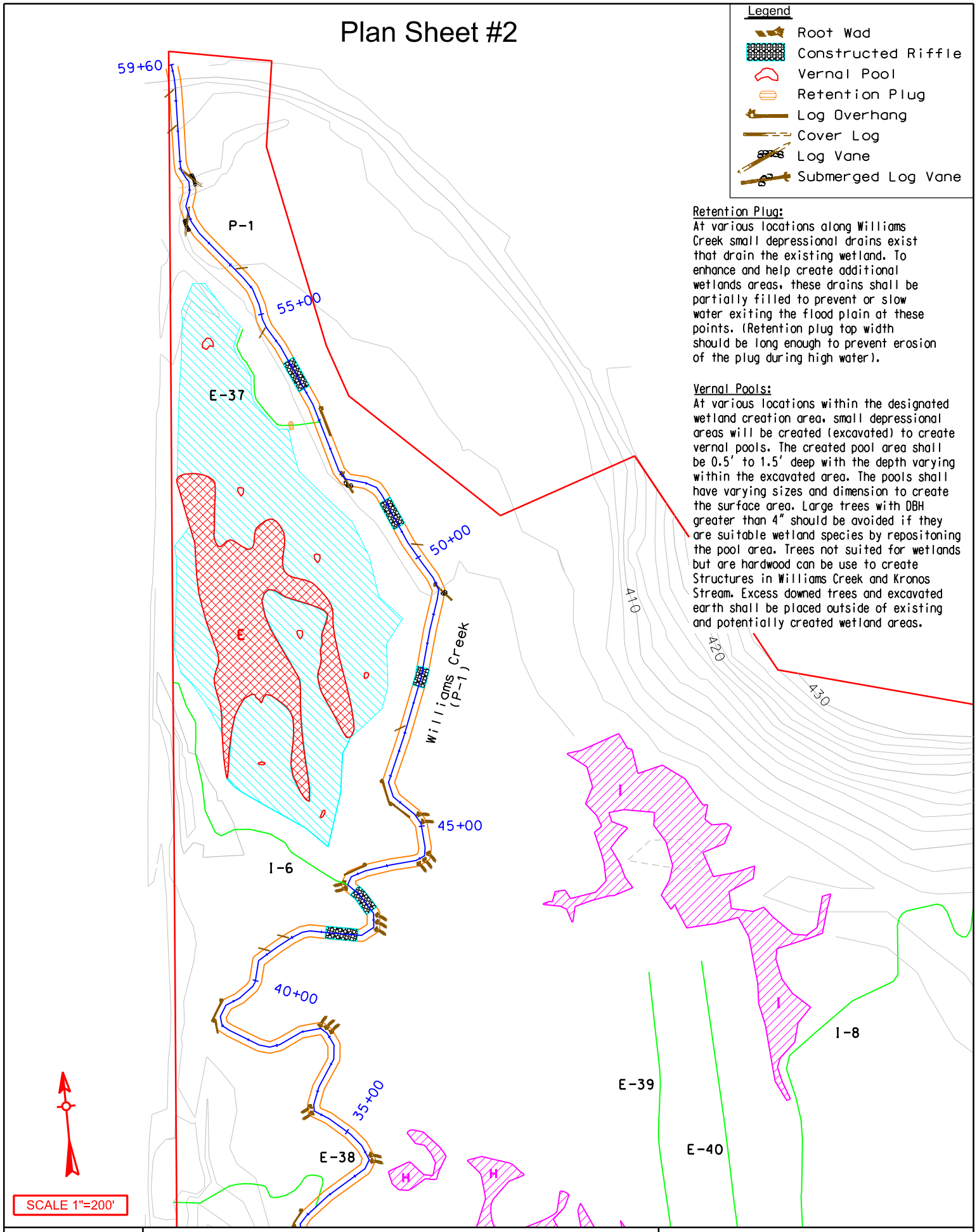


Retention Plug:
At various locations along Williams Creek small depressional drains exist that drain the existing wetland. To enhance and help create additional wetlands areas, these drains shall be partially filled to prevent or slow water exiting the flood plain at these points. (Retention plug top width should be long enough to prevent erosion of the plug during high water).

Vernal Pools:
At various locations within the designated wetland creation area, small depressional areas will be created (excavated) to create vernal pools. The created pool area shall be 0.5' to 1.5' deep with the depth varying within the excavated area. The pools shall have varying sizes and dimension to create the surface area. Large trees with DBH greater than 4" should be avoided if they are suitable wetland species by repositoning the pool area. Trees not suited for wetlands but are hardwood can be use to create Structures in Williams Creek and Kronos Stream. Excess downed trees and excavated earth shall be placed outside of existing and potentially created wetland areas.

T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE - RESTORATION, PRESERVATION & CREATION			STREAMS: UT'S OF WILLIAMS CREEK & WILLIAMS CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: PLAN SHEET #1	EXHIBIT 25

Plan Sheet #2



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T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE SITE - RESTORATION, PRESERVATION & CREATION			STREAMS: UT'S OF WILLIAMS CREEK & WILLIAMS CREEK	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: PLAN SHEET #2	EXHIBIT 26

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE SITE - WILLIAMS CREEK PROFILE

COUNTY: OHIO

STATE: KY

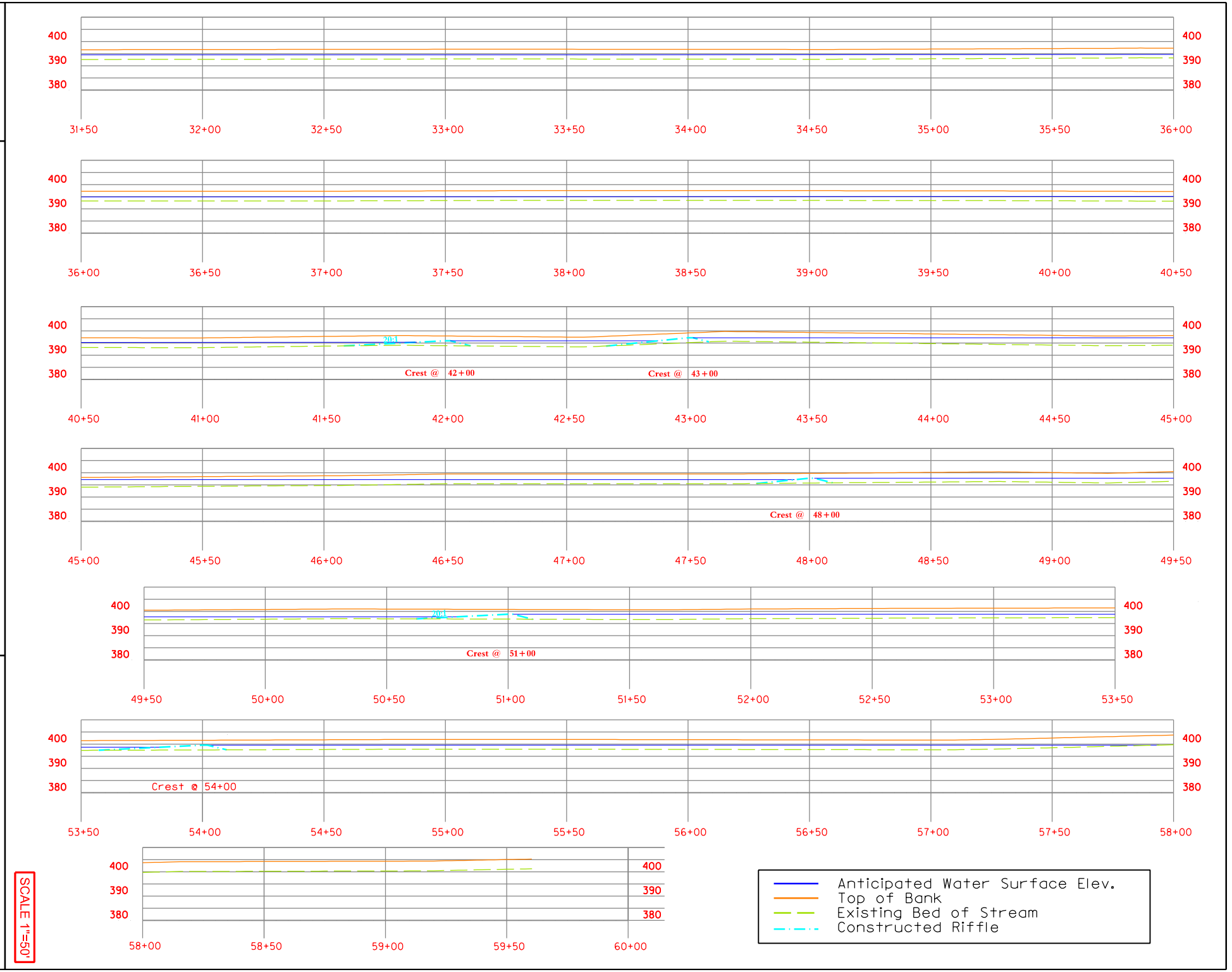
NEAR: CENTERTOWN

STREAMS: UT'S OF WILLIAMS CREEK & WILLIAMS CREEK

PROFILE SHEET #1

EXHIBIT 27

SCALE 1"=50'



T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE SITE - WILLIAMS CREEK PROFILE

COUNTY: OHIO

STATE: KY

NEAR: CENTERTOWN

STREAMS: UT'S OF WILLIAMS CREEK & WILLIAMS CREEK

PROFILE SHEET #2

EXHIBIT 28

T.H.E. Engineers, Inc.

PROJECT: WARDEN WASTE SITE - KRONOS STREAM PROFILE

COUNTY: OHIO

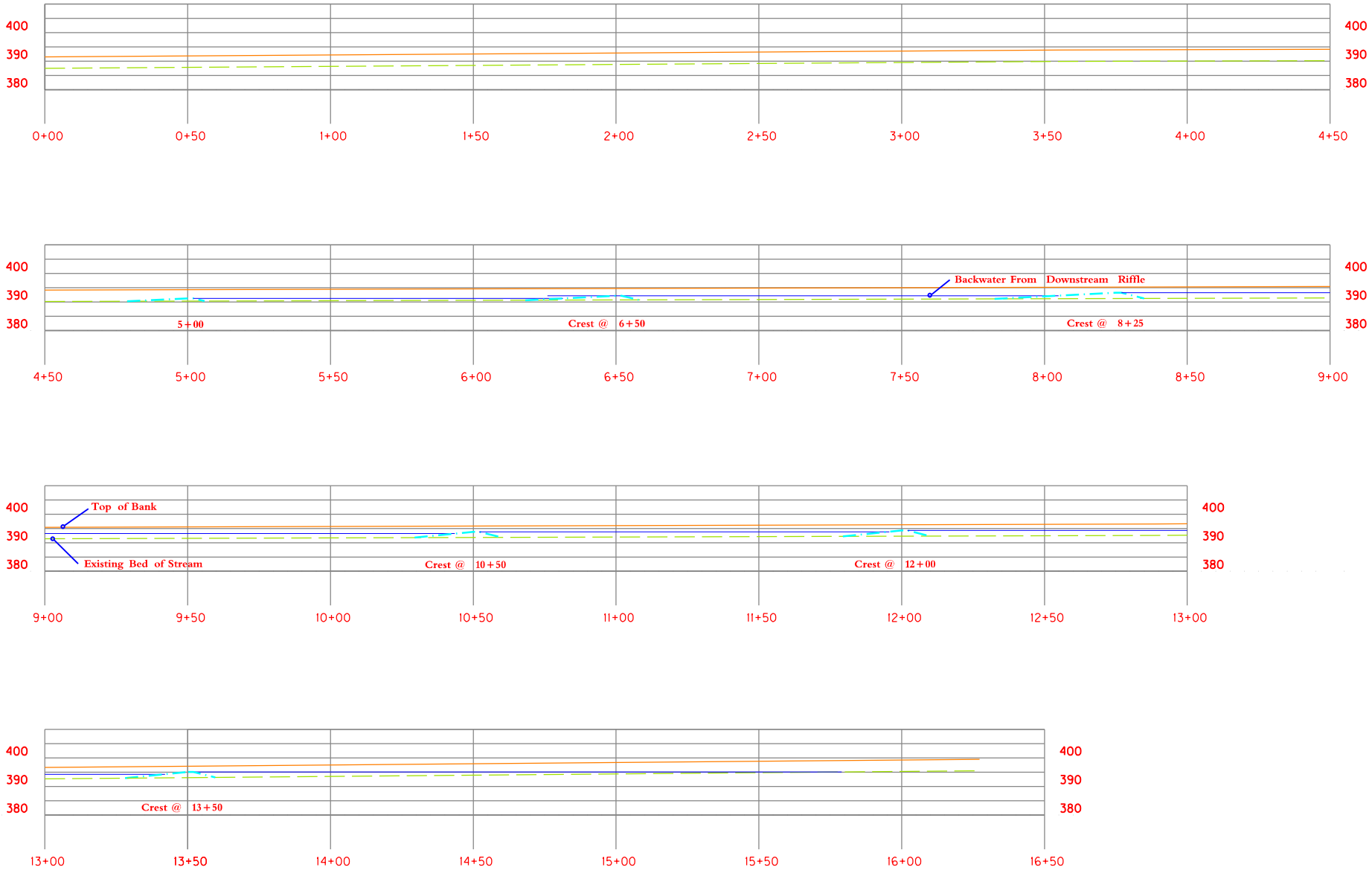
STATE: KY

NEAR: CENTERTOWN

STREAMS: UT'S OF WILLIAMS CREEK & WILLIAMS CREEK

PROFILE SHEET #2

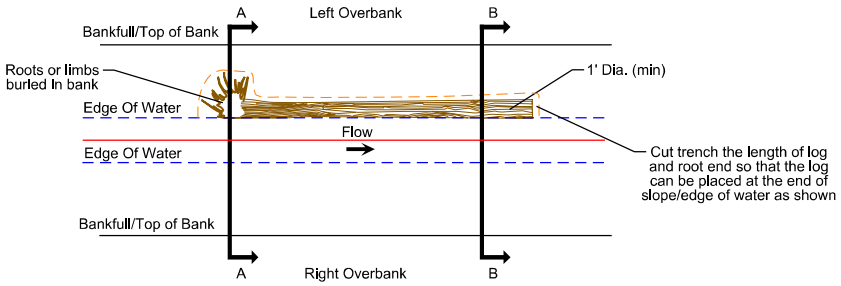
EXHIBIT 29

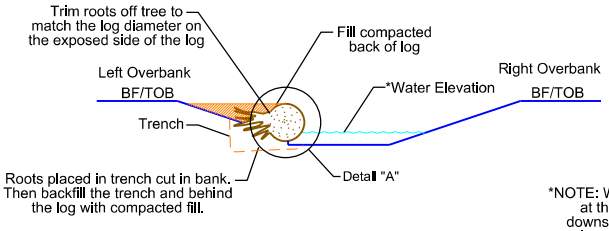


Habitat Structure Details

Williams Creek and Kronos Channel

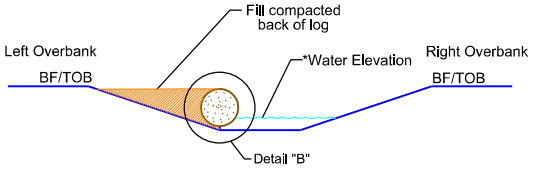
Log Overhang Structure



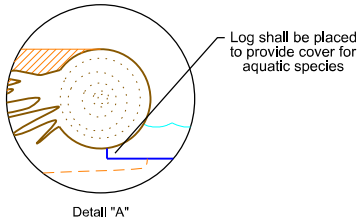


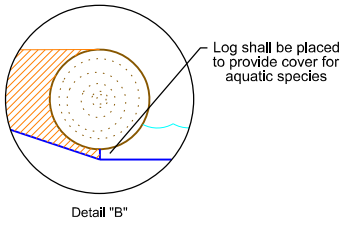
Section A-A

*NOTE: Water level established by elevation at the centerline of flow for the first downstream constructed riffle. A footer log may be used to elevate the log overhang structure to the proper level.

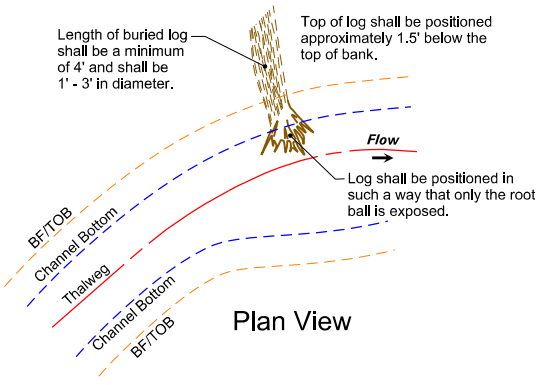


Section B-B



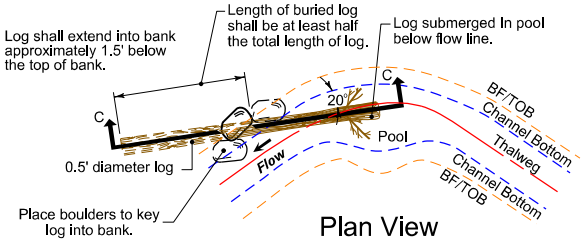


Root Wad

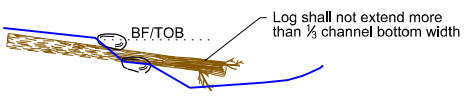


Plan View

Submerged Log Structure



Plan View



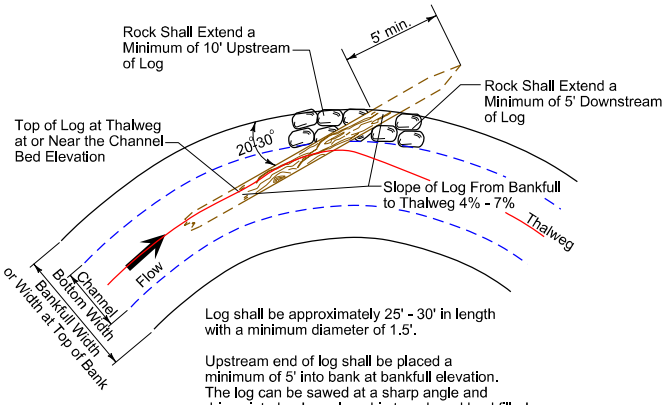
Section C-C

T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION			STREAM: WILLIAMS CREEK AND KRONOS CHANNEL	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: HABITAT STRUCTURE DETAILS	EXHIBIT 30

Habitat Structure Details

Williams Creek and Kronos Channel

Log Vane



Log shall be approximately 25' - 30' in length with a minimum diameter of 1.5'.

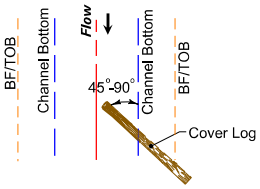
Upstream end of log shall be placed a minimum of 5' into bank at bankfull elevation. The log can be sawed at a sharp angle and driven into bank or placed in trench and backfilled.

Downstream end of log shall be placed in the channel bottom at center of thalweg.

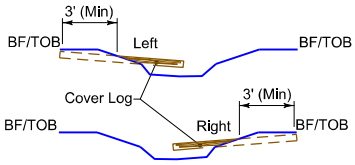
Rock protection shall be placed along the bank upstream and downstream of the log. Rock placement shall begin at channel bottom toe of slope and extend to bankfull elevation or to 1.0' below the topb of bank, whichever is greater. Rock shall be a minimum of 1.5' diameter and keyed into channel bank.

The log at bankfull shall be buried into the channel bank a minimum of 5'.

Cover Log



Plan View

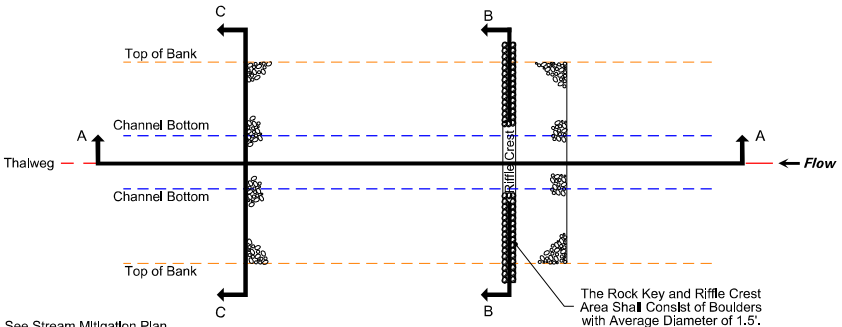


Cross Section View

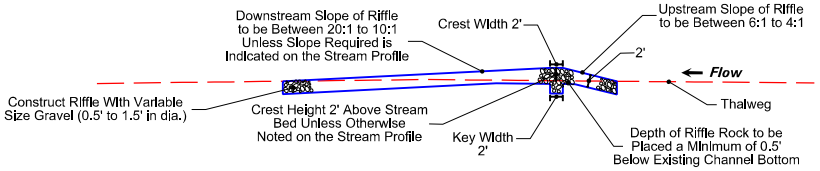
Cover log shall consist of a 0.5' to 1.0' diameter log placed at or just below the anticipated water line created by backwater from the first downstream constructed riffle. One end of log will extend a minimum of 3.0' into channel bank and other end will extend to ¼ to⅓ channel bottom width. The log shall be angled in upstream direction.

Log will alternate sides. (See Plan Sheets)

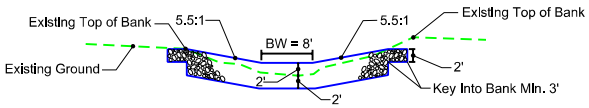
Constructed Riffle



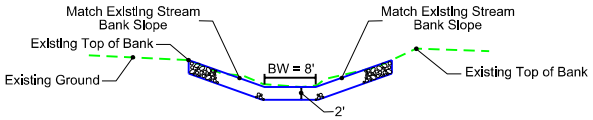
Plan View



Riffle Profile Along Thalweg (Section A-A)



Section B-B
Through Crest of Riffle

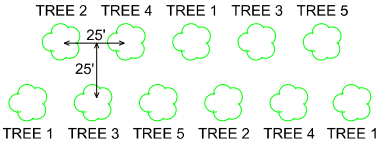


Section C-C
At Either End of Riffle

T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION			STREAM: WILLIAMS CREEK AND KRONOS CHANNEL	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: HABITAT STRUCTURE DETAILS	EXHIBIT 31

RIPARIAN ZONE PLANTING NOTES
(USE OPTION ONE OR OPTION TWO FOR TREE PLANTINGS)

PLAN VIEW: PLANTING DETAIL
RPM Riparian Trees (Option One)



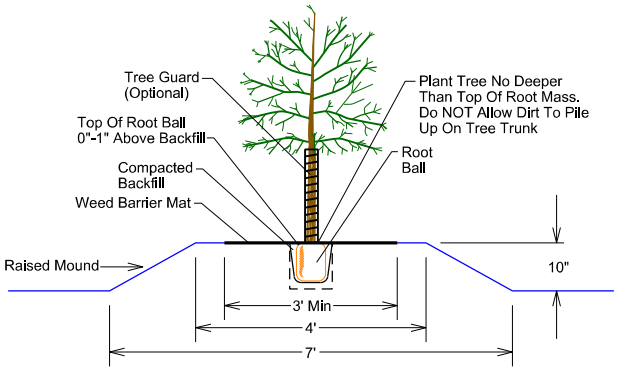
RPM RIPARIAN TREE PLANTINGS (OPTION ONE)

1. Only trees that have been produced by the Root Production Method (RPM) shall be planted in the Riparian zone.
2. The trees shall be three gallon container grown.
3. The trees shall be planted between the dates of October 1 and December 15.
4. Trees in the same row shall be planted on 25 foot spacing.
5. ✱ The first row of trees nearest the channel shall be planted approximately 8 feet beyond the shrub plantings.
6. The second row shall be planted 25 feet behind the first row. The subsequent rows will also be on 25 foot spacing.
7. The trees shall be planted in a staggered pattern, not one directly behind the other.
8. ✱ The trees shall be planted with alternating species.

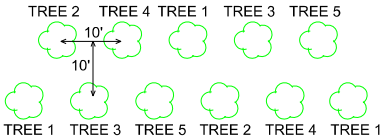
RECOMMENDED PROCEDURES FOR PLANTING RPM TREES

1. Site preparation - trees are to be planted on a raised mound of existing soil. The mound shall be 8-10 inches high after mild compaction. The base of the mound shall have a minimum width of seven feet with a flat crown (top) at approximately four feet.
2. The hole shall be approximately the same size as the container (10 inch diameter-8 inch depth).
3. ✱ After unloading trees, they shall be watered thoroughly and protected from excessive heat or cold. Do not allow rootball to freeze or dry out.
4. ✱ If the trees are not to be planted for several days or weeks, they should be watered every 3-4 days and again immediately before planting.
5. ✱ Remove the plastic container in which the trees have been growing prior to planting. Do not disturb rootball after container has been removed.
6. ✱ Do not plant trees any deeper than the level at which they were growing in the container. It is acceptable to plant the trees 1 inch above the level they were growing in the container.
7. Trees planted between October 1 and December 15, will require the application of a slow release fertilizer after planting. 1-1 1/2 tablespoons around drip zone is recommended. An analysis of 27-3-7 with I.B.D.U. or similar is recommended.

RPM TREE PLANTING DETAIL



PLAN VIEW: PLANTING DETAIL
NON - RPM Riparian Trees (Option Two)



TREE PLANTING (OPTION TWO)

1. Trees shall be container grown or bare root.
2. Bare root stock must be a minimum 30" (inches) in height and planted on 10' x 10' spacing in a staggered pattern.
3. Three-gallon trees shall be planted on 19' x 19' spacing in a staggered pattern.
4. NOTE: Option One notes with ✱ also apply to Option Two

THE FOLLOWING TREES WILL BE USED FOR BOTH OPTIONS

An equal amount of the following trees are to be planted throughout the riparian zone.

PERRINIAL AND INTERMITTENT STREAM TREE LIST

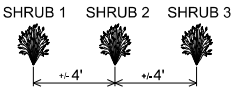
Tree 1: Shellbark hickory (Carya laciniosa)
Tree 2: Cherrybark oak (Quercus pagoda)
Tree 3: Willow oak (Quercus phellos)
Tree 4: Water oak (Quercus nigra)
Tree 5: White oak (Quercus alba)

EPHEMERAL STREAM TREE LIST

Tree 1: Shagbark hickory (Carya glabra)
Tree 2: American beech (Fagus grandifolia)
Tree 3: Shingle oak (Quercus imbricaria)
Tree 4: Post oak (Quercus stellata)
Tree 5: Shumard oak (Quercus shumardii)

SHRUB PLANTINGS
(These will not be RPM Plantings)

PLAN VIEW: SHRUB PLANTING DETAIL



The following shrubs are to be planted near bankfull elevation. See typical cross sections for number of rows and placement.

Shrub 1: Rough-leaf Dogwood (Cornus drummondii)
Shrub 2: Strawberry Bush (Euonymus americanus)
Shrub 3: Indigo Bush (Amorpha fruiticosa)

Three gallon container shrubs shall be planted on approximate 4' spacing with an equal amount of each species planted in random sequence.

SEEDING:

The following native grasses will be sown along both stream banks and throughout the riparian zone:

Switchgrass (Panicum virgatum)	20%
Virginia Wild Rye (Elymus virginicus)	20%
Rough Barnyard Grass (Echinochloa muricata)	10%
Annual Rye (Lolium perenne)	10%
Big bluestream (Andropogon gerardii)	20%
Forking panic grass/smooth panic grass (Dichanthelium dichotomum/ dichotomiflorum)	20%

Apply seed at a rate of 20 pounds/acre or as recommended by seed supplier.

Straw mulch or erosion control blanket shall be placed immediately following seeding.

Additional native species may be substituted based on approval of Army Corps of Engineers

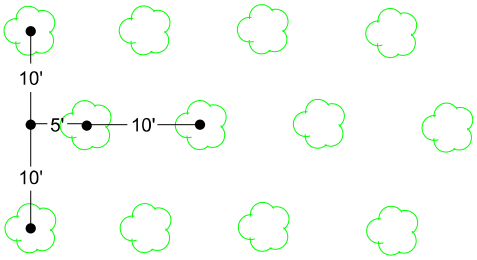
Riparian Zone Width will be a minimum of 100' for Intermittent streams

Shrub plantings and seeding will be the same for each option.

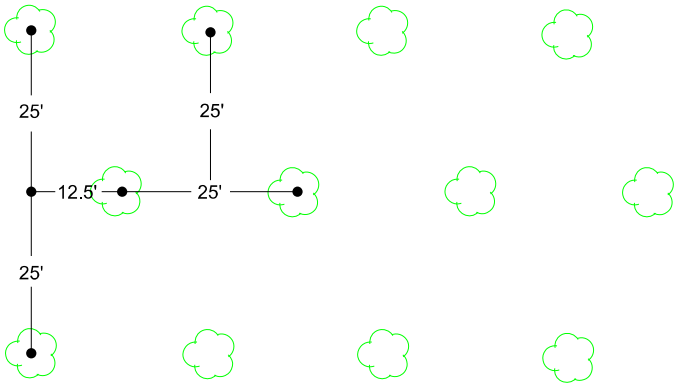
T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION			STREAM: WILLIAMS CREEK AND KRONOS CHANNEL	
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: STREAM PLANTING NOTES	EXHIBIT 32

WETLAND PLANTING DETAILS

If using tree seedlings, use 10 foot spacing.



If using RPM trees, use 25 foot spacing.
(non-RPM 3-gal. trees, use 19 foot spacing)



Planting Quantities Shall Meet Densities
Stated In The Wetland Mitigation Planting Plan.
Plant Locations Shall Be Irregularly Spaced And
Distributed Such That No Area Is Dominated
By Any Single Species

WETLAND PLANTING SPECIES LIST

TREES

Shellbark hickory (Carya laciniosa)
Cherrybark oak (Quercus pagoda)
Pin oak (Quercus palustris)
Swamp white oak (Quercus bicolor)
Willow oak (Quercus phellos)
Baldcypress (Taxodium distichum)

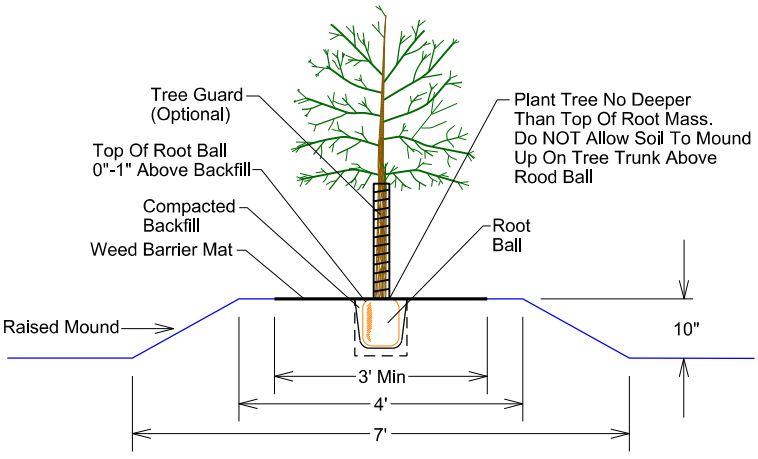
HERBACEOUS SEED MIX

Cardno JFNew's "Wooded Wetland Establishment" seed mix
OR
Green bulrush (Scirpus atrovirens)
Virginia wild rye (Elymus virginicus)
Fox sedge (Carex vulpinoidea)
Soft rush (Juncus effusus)
Woolgrass (Scirpus cyperinus)
Common sneezeweed (Helenium autumnale)

RECOMMENDED PROCEDURES FOR PLANTING RPM TREES

1. Site preparation - trees are to be planted on a raised mound of existing soil. The mound shall be 8-10 inches high after mild compaction. The base of the mound shall have a minimum width of seven feet with a flat crown (top) approximately three to four feet in width.
2. The hole shall be approximately the same size as the container (10 inch diameter-8 inch depth) or slightly larger.
3. After unloading trees, they shall be watered thoroughly and protected from excessive heat or cold. Do not allow rootball to freeze or dry out.
4. If the trees are not to be planted for several days or weeks, they should be watered every 3-4 days and again immediately before planting.
5. Remove the plastic container in which the trees have been growing prior to planting. Rough up the sides and bottom of planting hole so roots can penetrate the soil. Position tree in hole with top of root mass level with top of mound. Backfill hole with loose soil.
6. Trees planted between October 1 and December 10, will require the application of a slow release fertilizer after trees are dormant in late fall or winter. 1 tablespoon of Scottfield fertilizer 27-3-6 with IBDU or equal applied to the soil around the base of the trees is recommended.
7. Install 4'x4' weed mat, if desired.
8. Install 24" tree guard around tree, if desired.
9. Planted trees should be watered daily for 7 to 10 days, then watered every other day for the next 2 weeks (or the equivalent in rainfall).

RPM TREE PLANTING DETAIL



T.H.E. Engineers, Inc.	PROJECT: WARDEN WASTE MINE SITE - PROPOSED MITIGATION				
	COUNTY: OHIO	STATE: KY	NEAR: CENTERTOWN	ITEM: PROPOSED WETLAND PLANTING DETAIL	EXHIBIT 33

APPENDIX

(In the order they appear)

- Stream Assessment Sheets
- Photographs

- Wetland Delineation Forms
- Photographs

Low Gradient Stream Data Sheet

STREAM NAME: *P-1 US#1 (Williams Creek)* | LOCATION: *Warden Waste Site-upper segment of Williams Creek*

STATION: *WP 557* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-29.9* LONG: *87-03-47.7* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/19/14* TIME: *9:35* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☑	☑ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *45* °F. Inches rainfall in past 24 hours *0.1* in

25 % Cloud Cover

P-Chem: Temp (°F) *39.9* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *173.7* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*6.6*	ft
Stream Width BF	*8.5*	ft
Stream Bottom Width	*2.5*	ft
Avg. Bankfull Depth	*1.0*	ft
Avg. H²O Depth Riffle	*0.2*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☑ Surface Mining	☐ Construction	☐ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☑ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☑ Perennial ☐ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Redcedar
Sycamore
Pinoak
Blackgum

Canopy Cover;

☐ Fully Exposed (0-25%)
☑ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations;

☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)
RR berm next to channel

Substrate ☑ Est. ☐ P.C	Riffle *30* %	Run; *15* %	Pool *55* %
Silt/Clay (<0.06 mm)	*30*	*75*	*80*
Sand (0.06-2 mm)	*10*	*10*	*10*
Gravel (2-64 mm)	*60*	*15*	*10*
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 (12) 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 (11)**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 (6)**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **89**

NOTES/COMMENTS; F4 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *P-1 US #2 (Williams Creek)* | LOCATION: *Warden Waste Site-near confluence of East Fork*

STATION: *WP558* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-25.2* LONG: *87-03-46.6* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/19/14* TIME: *10:00* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
☑	☑ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *46* °F. Inches rainfall in past 24 hours *0.1* in

25 % Cloud Cover

P-Chem: Temp (°F) *37.4* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *257.0* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*4.0*	ft
Stream Width BF	*10.5*	ft
Stream Bottom Width	*1.0*	ft
Avg. Bankfull Depth	*1.0*	ft
Avg. H²O Depth Riffle	*0.1*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;
☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;
☑ Perennial ☐ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:
Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Red maple
Sycamore
Pinoak
Walnut
Tulip poplar

Canopy Cover;
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☑ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations;
☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)
Berm next to channel

Substrate ☑ Est. ☐ P.C	Riffle *10* %	Run; *10* %	Pool *80* %
Silt/Clay (<0.06 mm)	*10*	*10*	*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)	*90*	*90*	
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
	Condition Category			
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **97**

NOTES/COMMENTS; F4/6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *P-1 MS (Williams Creek)* | LOCATION: *Warden Waste Site-middle section*

STATION: *WP 645* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-09.6* LONG: *87-03-43.8* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/19/14* TIME: *1:45* ET ☐AM ☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now / Past 24 hours

- ☐ / ☐ Heavy rain
- ☐ / ☐ Steady rain
- ☐ / ☑ Intermittent showers
- *Clear* ☑ / ☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *60* °F. Inches rainfall in past 24 hours *0.1* in

5 % Cloud Cover

P-Chem: Temp (°F) *46.6* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *258.0* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*8-10*	ft
Stream Width BF	*12.0*	ft
Stream Bottom Width	*3.0*	ft
Avg. Bankfull Depth	*1.5*	ft
Avg. H²O Depth Riffle	*0.3*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☑ Perennial ☐ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Maple
Redcedar
Pinoak
Swamp chestnut oak

Canopy Cover;

☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations;

☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle *30* %	Run; *30* %	Pool *40* %
Silt/Clay (<0.06 mm)	*20*	*25*	*80*
Sand (0.06-2 mm)	*20*	*25*	*10*
Gravel (2-64 mm)	*60*	*50*	*10*
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 (11)**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 (7) 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 (11)**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score 95

NOTES/COMMENTS; F4/6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *P-1DS (Williams Creek)* | LOCATION: *Warden Waste Site-lower end of site near Rt 69*

STATION: *WP719* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-09.6* LONG: *87-03-43.8* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/20/14* TIME: *9:00* ET ☐AM ☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now / Past 24 hours

- ☐ / ☐ Heavy rain
- ☐ / ☐ Steady rain
- ☐ / ☑ Intermittent showers
- *Clear* ☑ / ☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *50* °F. Inches rainfall in past 24 hours *0.1* in

100 % Cloud Cover

P-Chem: Temp (°F) *36.5* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *263.0* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*5.0*	ft
Stream Width BF	*10.0*	ft
Stream Bottom Width	*3.0*	ft
Avg. Bankfull Depth	*1.5*	ft
Avg. H²O Depth Riffle	*0.3*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☑ Perennial ☐ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Sugar maple
Beech
Hophornbeam
Swamp chestnut oak

Canopy Cover;

☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☑ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations;

☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle *5* %	Run; *5* %	Pool *90* %
Silt/Clay (<0.06 mm)	*90*	*90*	*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)	*10*	*10*	
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score 97

NOTES/COMMENTS; F6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *P-2US* | LOCATION: *Warden Waste Site-southwest corner of site near Rt 69*

STATION: *WP479* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-23-58.9* LONG: *87-03-48.0* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/18/14* TIME: *2:21* ET ☐AM ☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now / Past 24 hours

- ☐ / ☐ Heavy rain
- ☐ / ☐ Steady rain
- ☐ / ☑ Intermittent showers
- *Clear* ☑ / ☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *54* °F. Inches rainfall in past 24 hours *0.24* in

15 % Cloud Cover

P-Chem: Temp (°F) *42.4* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *431.0* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*5.6*	ft
Stream Width BF	*10.0*	ft
Stream Bottom Width	*1.5*	ft
Avg. Bankfull Depth	*1-1.5*	ft
Avg. H²O Depth Riffle	*0.35*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

- ☐ Surface Mining
- ☐ Deep Mining
- ☐ Oil Wells
- ☐ Land Disposal
- ☐ Construction
- ☐ Commercial
- ☐ Industrial
- ☐ Row Crops
- ☑ Forest
- ☐ Pasture/Grazing
- ☐ Silviculture
- ☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

- ☐ Dams
- ☐ Bridge Abutments
- ☐ Island
- ☐ Waterfalls
- ☐ Other
- ☐ Culverts

Stream Flow;

- ☐ Dry
- ☐ Pooled
- ☑ High
- ☐ Low
- ☐ Normal
- ☐ Very Rapid or Torrential

Stream Type;

- ☑ Perennial
- ☐ Intermittent
- ☐ Ephemeral
- ☐ Seep

Riparian Vegetation:

Dominate Type:

- ☑ Trees
- ☑ Shrubs
- ☐ Grasses
- ☑ Herbaceous

Number of Strata *3*

Dom. Tree/Shrub Taxa

Sugarberry
Redcedar
Blackgum
Red oak
Pin oak

Canopy Cover;

- ☐ Fully Exposed (0-25%)
- ☐ Partially Exposed (25-50%)
- ☑ Partially Shaded (50-75%)
- ☐ Fully Shaded (75-100%)

Channel Alterations;

- ☐ Dredging
- ☐ Channelization (☐ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; *60* %	Pool *40* %
Silt/Clay (<0.06 mm)		*20*	*20*
Sand (0.06-2 mm)		*40*	*40*
Gravel (2-64 mm)		*40*	*40*
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score 95

NOTES/COMMENTS; F5 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *P-2 DS* | LOCATION: *Warden Waste Site-southwest corner of site near Rt 69*

STATION: *WP473* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-23-55.2* LONG: *87-03-43.2* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/18/14* TIME: *1:18* ET ☐AM ☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☑ Intermittent showers
Clear ☑	☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *52* °F. Inches rainfall in past 24 hours *0.24* in

20 % Cloud Cover

P-Chem: Temp (°F) *43.9* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *508.0* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*6-7*	ft
Stream Width BF	*10.0*	ft
Stream Bottom Width	*1.5*	ft
Avg. Bankfull Depth	*1.5*	ft
Avg. H²O Depth Riffle	*0.4*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;
☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;
☑ Perennial ☐ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:
Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Sweetgum *Maple*
Walnut *Sugarberry*
American elm *Blackgum*
Redcedar
Red oak

Canopy Cover;
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☑ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations;
☐ Dredging
☐ Channelization
(☐ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; *40* %	Pool *60* %
Silt/Clay (<0.06 mm)		*85*	*85*
Sand (0.06-2 mm)		*10*	*10*
Gravel (2-64 mm)		*5*	*5*
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **98**

NOTES/COMMENTS; $F6_E$ Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *I-6* | LOCATION: *Warden Waste Site*

STATION: *WP 634* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-18.6* LONG: *87-03-46.2* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/19/14* TIME: *12:49* ET ☐AM ☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now / Past 24 hours

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☑ Intermittent showers
Clear ☑	☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *50* °F. Inches rainfall in past 24 hours *0.1* in

15 % Cloud Cover

P-Chem: Temp (°F) *43.9* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *651.0* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*5-6*	ft
Stream Width BF	*10.0*	ft
Stream Bottom Width	*2.0*	ft
Avg. Bankfull Depth	*.75-1*	ft
Avg. H²O Depth Riffle	*0.1*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;
☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;
☐ Perennial ☑ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:
Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Sycamore
Swamp chestnut oak
Pinoak
Red maple
Sugar maple

Canopy Cover;
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations;
☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle *10* %	Run; *10* %	Pool *80* %
Silt/Clay (<0.06 mm)	*90*	*90*	*90*
Sand (0.06-2 mm)	*10*	*10*	*10*
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 (12) 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**(10) 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**(5) 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **114**

NOTES/COMMENTS; F6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *I-7* | LOCATION: *Warden Waste Site*

STATION: *WP 555* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-23-54.0* LONG: *87-03-46.6* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/19/14* TIME: *8:40* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now / Past 24 hours

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☑ Intermittent showers
Clear ☑	☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *40* °F. Inches rainfall in past 24 hours *0.1* in

15 % Cloud Cover

P-Chem: Temp (°F) *37.0* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *191.0* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*4.0*	ft
Stream Width BF	*10.0*	ft
Stream Bottom Width	*1.0*	ft
Avg. Bankfull Depth	*0.75*	ft
Avg. H²O Depth Riffle	*0.3*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;
☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;
☐ Perennial ☑ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:
Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Sycamore
Redcedar
Pinoak
Cottonwood

Canopy Cover;
☐ Fully Exposed (0-25%)
☑ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations;
☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; *100* %	Pool _____ %
Silt/Clay (<0.06 mm)		*100*	
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
	Condition Category			
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**(10) 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 (7) 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**(5) 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **108**

NOTES/COMMENTS; E6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *I-8US* | LOCATION: *Warden Waste Site*

STATION: *WP 210* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-14.7* LONG: *87-03-35.8* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *3/10/14* TIME: *6:15* ET ☐AM ☑☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
Clear ☑	☑ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *63* °F. Inches rainfall in past 24 hours *0.0* in

0 % Cloud Cover

P-Chem: Temp (°F) *54.9* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *417* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*2.0*	ft
Stream Width BF	*3.0*	ft
Stream Bottom Width	*0.5*	ft
Avg. Bankfull Depth	*0.75*	ft
Avg. H²O Depth Riffle	*0.1*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;
☐ Dry ☐ Pooled ☐ Low ☑ Normal
☐ High ☐ Very Rapid or Torrential

Stream Type;
☐ Perennial ☑ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:
Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Red maple
Pinoak
Redceadar
Sycamore
Beech

Canopy Cover;
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations;
☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle *20* %	Run; *20* %	Pool *60* %
Silt/Clay (<0.06 mm)	*90*	*90*	*90*
Sand (0.06-2 mm)	*10*	*10*	*10*
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 (11)**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 (12) 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 (9) 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score 125

NOTES/COMMENTS; E6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *I-8DS* | LOCATION: *Warden Waste Site*

STATION: *WP 765* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-06.0* LONG: *87-03-37.9* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/20/14* TIME: *10:49* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

	Now	Past 24 hours
	☐	☐ Heavy rain
	☐	☐ Steady rain
	☐	☑ Intermittent showers
Clouds	☑	☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow*

☐ Yes ☑ No

Air temperature *60* °F. Inches rainfall in past 24 hours *0.1* in

90 % Cloud Cover

P-Chem: Temp (°F) *49.8* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *317* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*1.5-2*	ft
Stream Width BF	*8.0*	ft
Stream Bottom Width	*1.0*	ft
Avg. Bankfull Depth	*0.5*	ft
Avg. H²O Depth Riffle	*0.1*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☐ Perennial ☑ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:

☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous

Number of Strata *3*

Dom. Tree/Shrub Taxa

Spicebush *Maple*
Pinoak
Sugarberry
Sycamore
Swamp chestnut oak

Canopy Cover;

☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations;

☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; *90* %	Pool *10* %
Silt/Clay (<0.06 mm)		*100*	*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score 121

NOTES/COMMENTS; $E6_F$ Rosgen stream type. Slightly incised in places, especially at lower end.

Low Gradient Stream Data Sheet

STREAM NAME: *I-9* | LOCATION: *Warden Waste Site*

STATION: *WP 273* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-04.4* LONG: *87-03-28.0* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *3/11/14* TIME: *11:34* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
Clear ☑	☑ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *70* °F. Inches rainfall in past 24 hours *0.0* in

5 % Cloud Cover

P-Chem: Temp (°F) *46.9* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *111.9* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*2-3*	ft
Stream Width BF	*3.5-4*	ft
Stream Bottom Width	*1.0*	ft
Avg. Bankfull Depth	*0.5*	ft
Avg. H²O Depth Riffle	*0.1*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☑ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☐ Perennial ☑ Intermittent
☐ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Red maple
Pinoak
Sweetgum
Sycamore

Canopy Cover;

☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations;

☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle *5* %	Run; *10* %	Pool *70* %
Silt/Clay (<0.06 mm)	*100*	*100*	*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **123**

NOTES/COMMENTS; E6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *E-37* | LOCATION: *Warden Waste Site*

STATION: *WP 562* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-25.6* LONG: *87-03-45.7* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/19/14* TIME: *10:26* ET ☐AM ☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☑ Intermittent showers
Clear ☑	☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow*
☐ Yes ☑ No
Air temperature *45* °F. Inches rainfall in past 24 hours *0.1* in
75 % Cloud Cover

P-Chem: Temp (°F) _____ D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. _____ ☐ Grab *NA*

INSTREAM WATERSHED FEATURES

Stream Width EOW	*6.0*	ft
Stream Width BF	*10.0*	ft
Stream Bottom Width	*2.5*	ft
Avg. Bankfull Depth	*1.0*	ft
Avg. H²O Depth Riffle		ft

LOCAL WATERSHED FEATURES:
Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:
☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;
☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;
☐ Perennial ☐ Intermittent
☑ Ephemeral ☐ Seep

Riparian Vegetation:
Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Pinoak
Swamp chestnut oak
Blackgum
Hickory

Canopy Cover;
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations;
☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; _____ %	Pool *100* %
Silt/Clay (<0.06 mm)			*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score 132

NOTES/COMMENTS; E6 Rosgen stream type. Old remnant channel. Could be incorporated into wetland mitigation as vernal pool.

Low Gradient Stream Data Sheet

STREAM NAME: *E-38* | LOCATION: *Warden Waste Site*

STATION: *WP 644* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-13.0* LONG: *87-03-47.7* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/19/14* TIME: *1:32* ET ☐AM ☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now / Past 24 hours

- ☐ / ☐ Heavy rain
- ☐ / ☐ Steady rain
- ☐ / ☑ Intermittent showers
- *Clear* ☑ / ☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *53* °F. Inches rainfall in past 24 hours *0.1* in

10 % Cloud Cover

P-Chem: Temp (°F) _____ D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. _____ ☐ Grab *NA*

INSTREAM WATERSHED FEATURES

Stream Width EOW	*1-1.25*	ft
Stream Width BF	*6.0*	ft
Stream Bottom Width	*0.5*	ft
Avg. Bankfull Depth	*0.5*	ft
Avg. H²O Depth Riffle	*0.1*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

- ☐ Surface Mining
- ☐ Deep Mining
- ☐ Oil Wells
- ☐ Land Disposal
- ☐ Construction
- ☐ Commercial
- ☐ Industrial
- ☐ Row Crops
- ☑ Forest
- ☐ Pasture/Grazing
- ☐ Silviculture
- ☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

- ☐ Dams
- ☐ Island
- ☐ Other
- ☐ Bridge Abutments
- ☐ Waterfalls
- ☐ Culverts

Stream Flow;

- ☐ Dry
- ☑ High
- ☐ Pooled
- ☐ Very Rapid or Torrential
- ☐ Low
- ☐ Normal

Stream Type;

- ☐ Perennial
- ☑ Ephemeral
- ☐ Intermittent
- ☐ Seep

Riparian Vegetation:

Dominate Type:

- ☑ Trees
- ☐ Grasses
- ☑ Shrubs
- ☑ Herbaceous

Number of Strata *3*

Dom. Tree/Shrub Taxa

Pin oak
Sweetgum
Sugar maple
Beech
Green ash

Canopy Cover;

- ☐ Fully Exposed (0-25%)
- ☐ Partially Exposed (25-50%)
- ☐ Partially Shaded (50-75%)
- ☑ Fully Shaded (75-100%)

Channel Alterations;

- ☐ Dredging
- ☐ Channelization (☐ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C

	Riffle %	Run; *90* %	Pool *10* %
Silt/Clay (<0.06 mm)		*100*	*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 (11)**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 (8) 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 (6)**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **117**

NOTES/COMMENTS; F6b Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *E-39* | LOCATION: *Warden Waste Site*

STATION: *WP 773* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-09.8* LONG: *87-03-38.0* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/20/14* TIME: *11:31* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now / Past 24 hours

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☑ Intermittent showers
Clouds ☑	☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow*

☐ Yes ☑ No

Air temperature *60* °F. Inches rainfall in past 24 hours *0.1* in

90 % Cloud Cover

P-Chem: Temp (°F) *49.5* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *76.2* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*2-2.5*	ft
Stream Width BF	*4.0*	ft
Stream Bottom Width	*1.5*	ft
Avg. Bankfull Depth	*0.4*	ft
Avg. H²O Depth Riffle	*0.1*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☐ Perennial ☐ Intermittent
☑ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:

☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous

Number of Strata *3*

Dom. Tree/Shrub Taxa

Red maple
Pinoak
Redceadar
Sycamore

Canopy Cover;

☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations;

☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; *70* %	Pool *30* %
Silt/Clay (<0.06 mm)		*100*	*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **124**

NOTES/COMMENTS; E6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *E-40* | LOCATION: *Warden Waste Site – drains to Wetland G*

STATION: *WP 727* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-10.2* LONG: *87-03-37.0* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/20/14* TIME: *10:22* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER: Now / Past 24 hours

- ☐ / ☐ Heavy rain
- ☐ / ☐ Steady rain
- ☐ / ☑ Intermittent showers
- *Clouds* ☑ / ☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *60* °F. Inches rainfall in past 24 hours *0.1* in

90 % Cloud Cover

P-Chem: Temp (°F) _____ D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. _____ ☐ Grab *NA*

INSTREAM WATERSHED FEATURES

Stream Width EOW	*2-3*	ft
Stream Width BF	*4.5*	ft
Stream Bottom Width	*1.5*	ft
Avg. Bankfull Depth	*0.7*	ft
Avg. H²O Depth Riffle		ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

- ☐ Surface Mining
- ☐ Deep Mining
- ☐ Oil Wells
- ☐ Land Disposal
- ☐ Construction
- ☐ Commercial
- ☐ Industrial
- ☐ Row Crops
- ☑ Forest
- ☐ Pasture/Grazing
- ☐ Silviculture
- ☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

- ☐ Dams
- ☐ Island
- ☐ Other
- ☐ Bridge Abutments
- ☐ Waterfalls
- ☐ Culverts

Stream Flow;

- ☐ Dry
- ☑ High
- ☐ Pooled
- ☐ Very Rapid or Torrential
- ☐ Low
- ☐ Normal

Trickle-snow melt

Stream Type;

- ☐ Perennial
- ☑ Ephemeral
- ☐ Intermittent
- ☐ Seep

Riparian Vegetation:

Dominate Type:

- ☑ Trees
- ☐ Grasses
- ☑ Shrubs
- ☑ Herbaceous

Number of Strata *3*

Dom. Tree/Shrub Taxa

Red maple
Pinoak
Redcedar
Sweetgum
Elm

Canopy Cover;

- ☐ Fully Exposed (0-25%)
- ☐ Partially Exposed (25-50%)
- ☐ Partially Shaded (50-75%)
- ☑ Fully Shaded (75-100%)

Channel Alterations;

- ☐ Dredging
- ☐ Channelization (☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; _____ %	Pool *100* %
Silt/Clay (<0.06 mm)			*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **130**

NOTES/COMMENTS; E6 Rosgen stream type. Stream or wetland? Channel not well defined.

Low Gradient Stream Data Sheet

STREAM NAME: *E-41* | LOCATION: *Warden Waste Site*

STATION: *WP 718* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-23-57.6* LONG: *87-03-32.3* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *2/20/14* TIME: *1:32* ET ☐AM ☑PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☑ Intermittent showers
Clear ☑	☐ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *50* °F. Inches rainfall in past 24 hours *0.1* in

100 % Cloud Cover

P-Chem: Temp (°F) *45.1* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *64.1* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*2-2.5*	ft
Stream Width BF	*5.0*	ft
Stream Bottom Width	*1.0*	ft
Avg. Bankfull Depth	*0.4*	ft
Avg. H²O Depth Riffle	*0.1*	ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☐ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☐ Perennial ☐ Intermittent
☑ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Sycamore
Pinoak
Red maple

Canopy Cover;

☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☑ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations;

☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; *80* %	Pool *20* %
Silt/Clay (<0.06 mm)		*100*	*100*
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **128**

NOTES/COMMENTS; E6 Rosgen stream type.

Low Gradient Stream Data Sheet

STREAM NAME: *E-42* | LOCATION: *Warden Waste Site*

STATION: *WP 258* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-23-59.5* LONG: *87-03-28.9* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *3/11/14* TIME: *11:03* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
Clear ☑	☑ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *70* °F. Inches rainfall in past 24 hours *0.0* in

10 % Cloud Cover

P-Chem: Temp (°F) *48.9* D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. *185.1* ☐ Grab

INSTREAM WATERSHED FEATURES

Stream Width EOW	*2.0*	ft
Stream Width BF	*2.5*	ft
Stream Bottom Width	*1.0*	ft
Avg. Bankfull Depth	*0.25*	ft
Avg. H²O Depth Riffle		ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☑ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☐ Perennial ☐ Intermittent
☑ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Red maple *River birch*
Pinoak
Redceadar
Sycamore
Beech

Canopy Cover;
☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☑ Partially Shaded (50-75%)
☐ Fully Shaded (75-100%)

Channel Alterations;
☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; *100* %	Pool _____ %
Silt/Clay (<0.06 mm)		*100*	
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
Cobble (64-256 mm)			
Boulders (>256 mm)			
Bedrock			

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient.	30-50% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10-% stable habitat" lack of habitat is obvious; substrate unstable or lacking.
SCORE	**20 19 18 17 16**	**15 14 13 12 (11)**	**10 9 8 7 6**	**5 4 3 2 1 0**
2. Pool Substrate/ Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	**20 19 18 17 16**	**15 14 13 12 (11)**	**10 9 8 7 6**	**5 4 3 2 1 0**
3. Pool Availability	Even mix of large shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**(5) 4 3 2 1 0**

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy despoits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
7. Channel Sinuosity	The bends in the stream increase the stream length 3-4 times longer than if it was a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2-1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	**20 19 18 17 16**	**15 14 13 12 11**	**10 9 8 7 6**	**5 4 3 2 1 0**
8. Bank Stability	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable, infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable, 30-60% of bank in reach has areas of erosion, high erosion potential during floods.	Unstable, many eroded areas, "raw" areas frequently along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruptive of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score **109**

NOTES/COMMENTS; E6 Rosgen stream type. Some incision at lower end.

Low Gradient Stream Data Sheet

STREAM NAME: *E-43* | LOCATION: *Warden Waste Site*

STATION: *WP 261* | DRAINAGE AREA (AC) | BASIN/WATERSHED *Green River/Williams Creek*

LAT: *37-24-02.3* LONG: *87-03-24.5* | COUNTY; *Ohio* USGS 7.5 TOPO; *Equality*

DATE: *3/11/14* TIME: *11:03* ET ☑AM ☐PM | INVESTIGATORS; *John Bottom/Bill Sampson*

TYPE SAMPLE: ☐ P-CHEM ☐ Macroinvertebrate ☐ FISH ☐ BACT.

WEATHER:

Now	Past 24 hours
☐	☐ Heavy rain
☐	☐ Steady rain
☐	☐ Intermittent showers
Clear ☑	☑ Clear/sunny

Has there been a heavy rain in the last 7 days? *Snow* ☐Yes ☑No

Air temperature *70* °F. Inches rainfall in past 24 hours *0.0* in

10 % Cloud Cover

P-Chem: Temp (°F) _____ D.O. (mg/l) _____ % Saturation _____ pH(S.U.) _____ Cond. _____ ☐ Grab *NA*

INSTREAM WATERSHED FEATURES

Stream Width EOW	*1-1.5*	ft
Stream Width BF	*3.0*	ft
Stream Bottom Width	*0.75*	ft
Avg. Bankfull Depth	*0.35*	ft
Avg. H²O Depth Riffle		ft

LOCAL WATERSHED FEATURES:

Predominant Surrounding Land Use:

☐ Surface Mining	☐ Construction	☑ Forest
☐ Deep Mining	☐ Commercial	☐ Pasture/Grazing
☐ Oil Wells	☐ Industrial	☐ Silviculture
☐ Land Disposal	☐ Row Crops	☐ Urban Runoff/Storm Sewers

Hydraulic Structures:

☐ Dams ☐ Bridge Abutments
☐ Island ☐ Waterfalls
☐ Other ☐ Culverts

Stream Flow;

☐ Dry ☑ Pooled ☐ Low ☐ Normal
☑ High ☐ Very Rapid or Torrential

Stream Type;

☐ Perennial ☐ Intermittent
☑ Ephemeral ☐ Seep

Riparian Vegetation:

Dominate Type:
☑ Trees ☑ Shrubs
☐ Grasses ☑ Herbaceous
Number of Strata *3*

Dom. Tree/Shrub Taxa
Red maple *River birch*
Pinoak
Redceadar
Sycamore
Green ash

Canopy Cover;

☐ Fully Exposed (0-25%)
☐ Partially Exposed (25-50%)
☐ Partially Shaded (50-75%)
☑ Fully Shaded (75-100%)

Channel Alterations;

☐ Dredging
☐ Channelization
(☑ Full ☐ Partial)

Substrate ☑ Est. ☐ P.C	Riffle _____ %	Run; *100* %	Pool _____ %
Silt/Clay (<0.06 mm)		*100*	
Sand (0.06-2 mm)			
Gravel (2-64 mm)			
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SCORE	**20 19 18 17 16**	**15 14 13 12 (11)**	**10 9 8 7 6**	**5 4 3 2 1 0**
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SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
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SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
10. Riparian Vegetative Zone Width (score each bank riparian zone).	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities has inpacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE (LB)	**Left Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**
SCORE (RB)	**Right Bank 10 9**	**8 7 6**	**5 4 3**	**2 1 0**

Total Score 112

NOTES/COMMENTS; E6 Rosgen stream type.

Perennial 1 (P-1 US) – Upstream reach, looking upstream

Perennial 1 (P-1 MS) –Midstream reach, looking upstream

Perennial 1 (P-1 DS) – Downstream reach, looking upstream

Perennial 1 (P-1 DS) –Downstream reach, looking downstream

Perennial 2 (P-2 US) – Upstream reach, looking downstream

Perennial 2 (P-2 DS) –Downstream reach, looking upstream

Intermittent 6 (I-6) – Looking upstream

Intermittent 6 (I-6) – Looking downstream

Intermittent 7 (I-7) – Looking upstream

Intermittent 7 (I-7) – Looking downstream

Intermittent 8 (I-8US) – Looking upstream in upstream reach

Intermittent 8 (I-8US) – Looking downstream in upstream reach

Intermittent 8 (I-8DS) – Looking upstream in downstream reach

Intermittent 8 (I-8DS) – Looking downstream in downstream reach

Intermittent 9 (I-9) – Looking upstream

Intermittent 9 (I-9) – Looking downstream

Ephemeral 37 (E-37) – Looking upstream

Ephemeral 37 (E-37) – Looking downstream

Ephemeral 38 (E-38) – Looking upstream

Ephemeral 38 (E-38) – Looking downstream

Ephemeral 39 (E-39) – Looking upstream

Ephemeral 39 (E-39) – Looking downstream

Ephemeral 40 (E-40) – Looking upstream

Ephemeral 40 (E-40) – Looking downstream

Ephemeral 41 (E-41) – Looking upstream

Ephemeral 41 (E-41) – Looking downstream

Ephemeral 42 (E-42) – Looking upstream

Ephemeral 42 (E-42) – Looking downstream

Ephemeral 43 (E-43) – Looking upstream

Ephemeral 43 (E-43) – Looking downstream

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MITIGATION AREA – WETLAND D City/County: OHIO Sampling Date: 2/18/14
Applicant/Owner: ARMSTRONG COAL CO. – WARDEN WASTE SITE State: KY Sampling Point: WP 483
Investigator(s): BILL SAMPSON, JOHN BOTTOM Section, Township, Range: _____
Landform (hillslope, terrace, etc.): TOE OF HILL Local relief (concave, convex, none): CONCAVE Slope (%): 42%
Subregion (LRR or MLRA): LRR N Lat: 37°23'58.5" Long: 87°03'39.5" Datum: WGS 84
Soil Map Unit Name: STENDAL SILT LOAM NWI classification: PFO 1B
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓ No _____	
Wetland Hydrology Present?	Yes ✓ No _____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ✓ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No _____	Depth (inches): _____
Water Table Present?	Yes _____	No _____	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: 483

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Swamp chestnut oak (Quercus michauxii)	40	Yes	FACW
2. Pin oak (Q. palustris)	15	No	FACW
3. Ironwood (Carpinus caroliniana)	10	No	FAC
4.			
5.			
6.			
	65 = Total Cover		
50% of total cover: 32.5	20% of total cover: 13		
Sapling Stratum (Plot size: 15')			
1. Sweetgum (Liquidambar styraciflua)	5	Yes	FAC
2. Red maple (Acer rubrum)	20	Yes	FAC
3.			
4.			
5.			
6.			
	25 = Total Cover		
50% of total cover: 12.5	20% of total cover: 5		
Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5')			
1. Sedge (Carex sp.)	2	Yes	FACW+
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	2 = Total Cover		
50% of total cover: 1	20% of total cover: 0.4		
Woody Vine Stratum (Plot size: 5')			
1. Honeysuckle (Lonicera japonica)	2	Yes	FAC
2.			
3.			
4.			
5.			
	2 = Total Cover		
50% of total cover: 1	20% of total cover: 0.4		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: 483

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	7.5YR 6/2	70	7.5YR 5/6	30	C	M	SiCLo	
3-12	10YR 7/1	80	7.5YR 5/6	20				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: NONE

Depth (inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MITIGATION AREA-WETLAND E City/County: OHIO Sampling Date: 2/19/14
Applicant/Owner: ARMSTRONG COAL CO. - WARDEN WASTE SITE State: KY Sampling Point: WP568
Investigator(s): BILL SAMPSON, JOHN BOTTOM Section, Township, Range:
Landform (hillslope, terrace, etc.): FLOODPLAIN Local relief (concave, convex, none): CONCAVE Slope (%): <2%
Subregion (LRR or MLRA): LRR N Lat: 37°24'23.3 Long: 87°03'46.5" Datum: WGS84
Soil Map Unit Name: STENDAL SILT LOAM NWI classification: PFO2B
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: TWO SEPARATE WETLAND AREAS AT WEST SIDE OF SITE. AN OLD SECTION OF CHANNEL LIES ADJACENT TO WETLAND E.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ✓ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): ____
Water Table Present?	Yes ____	No ____	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): ____

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: WP 518

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Sycamore (Platanus occidentalis)	10	No	FACW
2. Sweetgum (Liquidambar styraciflua)	25	Yes	FAC
3. Red maple (Acer rubrum)	20	Yes	FAC
4.			
5.			
6.			
	55	= Total Cover	
50% of total cover: 27.5	20% of total cover: 11		

Sapling Stratum (Plot size: 15')			
1. Red maple (Acer rubrum)	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	5	= Total Cover	
50% of total cover: 2.5	20% of total cover: 1		

Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: 5')			
1. Sedge (Carex sp.)	2	Yes	FACW+
2. Christmas fern (P. acrostrichoides)	2	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	4	= Total Cover	
50% of total cover: 2	20% of total cover: 0.8		

Woody Vine Stratum (Plot size: 5')			
1. Honeysuckle (Lonicera japonica)	2	Yes	FAC
2.			
3.			
4.			
5.			
	2	= Total Cover	
50% of total cover: 1	20% of total cover: 0.4		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 83 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ____ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WP568

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 5/2	80	5YR 4/6	20	C	M	SiCLCO	
4+								BROWN W/TRACES OF GRAY

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: NONE

Depth (inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MITIGATION AREA - WETLAND F City/County: OHIO Sampling Date: 2/19/14
Applicant/Owner: ARMSTRONG COAL CO. - WARDEN WASTE SITE State: KY Sampling Point: WP656
Investigator(s): BILL SAMPSON, JOHN BOTTOM Section, Township, Range:
Landform (hillslope, terrace, etc.): FLOODPLAIN Local relief (concave, convex, none): CONCAVE Slope (%): 2
Subregion (LRR or MLRA): LRR N Lat: 37°23'59.8" Long: 87°03'33.4" Datum: NGS 84
Soil Map Unit Name: BONNIE SILT LOAM NWI classification: PFO1B
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: FINGER OF WETLAND F WITH UPSTREAM AND DOWNSTREAM WP's OF 716 & 717; UPPER 3/4 IS 15' WIDE, LOWER 1/4 IS 20' WIDE.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ✓ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ✓ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ____ Depth (inches): ____
Water Table Present? Yes ____ No ____ Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ✓ No ____ Depth (inches): ____

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: 656

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. River birch (Betula nigra)	10	Yes	FACW
2. Sweetgum (Liquidambar styraciflua)	15	Yes	FAC
3.	10	Yes	FACW
4.			
5.			
6.			
	35	= Total Cover	

50% of total cover: 17.5 20% of total cover: 7

Sapling Stratum (Plot size: 15')			
1. Sweetgum (Liquidambar styraciflua)	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	10	= Total Cover	

50% of total cover: 5 20% of total cover: 2

Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

50% of total cover: 20% of total cover:

Herb Stratum (Plot size: 5')			
1. Sedge (Carex sp.)	25	Yes	FACW†
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	25	= Total Cover	

50% of total cover: 12.5 20% of total cover: 5

Woody Vine Stratum (Plot size: 5')			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

50% of total cover: 20% of total cover:

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: E56

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 5/2	65	5YR 4/6	35	C	M	SiCl Lo	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None

Depth (Inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MITIGATION AREA - WETLAND G City/County: OHIO Sampling Date: 2/20/14
Applicant/Owner: ARMSTRONG COAL CO. - WARDEN WASTE SITE State: KY Sampling Point: WP 720
Investigator(s): BILL SAMPSON, JOHN BOTTOM Section, Township, Range:
Landform (hillslope, terrace, etc.): FLOODPLAIN Local relief (concave, convex, none): CONCAVE Slope (%): <2
Subregion (LRR or MLRA): LRR N Lat: 37° 24' 06.4" Long: 87° 03' 37.0" Datum: NGS 84
Soil Map Unit Name: BONNIE SILT LOAM NWI classification: PFO1B
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓ No ____	
Wetland Hydrology Present?	Yes ✓ No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ✓ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): ____
Water Table Present?	Yes ____	No ____	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): ____

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: 720

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. SYCAMORE (PLATANUS OCCIDENTALIS)	20	YES	FAC
2. PIN OAK (QUERCUS PALUSTRIS)	15	NO	FACW
3. SWAMP CHESTNUT OAK (Q. MICHAUXII)	10	NO	FACW
4. SWEETGUM (LIQUIDAMBAR STYRACIFLUA)	20	YES	FAC
5. RED MAPLE (ACER RUBRUM)	5	NO	FAC
6.			
	70	= Total Cover	

50% of total cover: 35 20% of total cover: 14

Sapling Stratum (Plot size: 15')			
1. RED MAPLE (A. RUBRUM	5	YES	FAC
2.			
3.			
4.			
5.			
6.			
	5	= Total Cover	

50% of total cover: 2.5 20% of total cover: 1

Shrub Stratum (Plot size: 15')			
1. IRONWOOD (CARPINUS CAROLINIANA)	5	YES	FAC
2. SPICEBUSH (LINDERA BENZOIN)	15	YES	FAC
3.			
4.			
5.			
6.			
	20	= Total Cover	

50% of total cover: 10 20% of total cover: 4

Herb Stratum (Plot size: 5')			
1. DEAD			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
		= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 5')			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: 720

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2								ORGANIC LAYER
2-10	10YR 6/1	60	5YR 4/6	40	C	M	SiCL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None

Depth (inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MITIGATION AREA- WETLAND H City/County: OHIO Sampling Date: 3/10/14
Applicant/Owner: ARMSTRONG COAL CO.- WARDEN WASTE SITE State: KY Sampling Point: WP 11
Investigator(s): BILL SAMPSON, JOHN BOTTOM Section, Township, Range:
Landform (hillslope, terrace, etc.): FLOODPLAIN Local relief (concave, convex, none): CONCAVE Slope (%): 2
Subregion (LRR or MLRA): LRR N Lat: 37° 24' 10.8" Long: 87° 03' 42.6" Datum: NGS 84
Soil Map Unit Name: BONNIE SILT LOAM NWI classification: PFO1B
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks: CONSISTS OF SEVERAL WETLAND AREAS NEAR EACH OTHER, INCLUDING AN OLD CHANNEL, AN OXBOW, AND A NARROW WETLAND WIDER AT ONE END ("P" SHAPED); PLUS TWO MORE NARROW WETLANDS.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ✓ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ✓ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): ____
Water Table Present?	Yes ____	No ____	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): ____

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: 11

Tree Stratum (Plot size: 10')	Absolute % Cover	Dominant Species?	Indicator Status
1. SWEETGUM (LIQUIDAMBAR STYRACIFLUA)	15	YES	FAC
2. RED MAPLE (ACER RUBRUM)	10	YES	FAC
3. PIN OAK (QUERCUS PALUSTRIS)	5	NO	FACW
4. ELM (ULMUS AMERICANA)	20	YES	FACW
5.			
6.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		
Sapling Stratum (Plot size: 10')			
1. SWEETGUM (L. STYRACIFLUA)	5	NO	FAC
2. RED MAPLE (A. RUBRUM)	15	YES	FAC
3.			
4.			
5.			
6.			
	20 = Total Cover		
50% of total cover: 10	20% of total cover: 4		
Shrub Stratum (Plot size: 10')			
1. SPICEBUSH (LINDERA BENZOIN)	10	YES	FACU
2. MULTIFLORA ROSE (ROSA MULTIFLORA)	5	NO	FAC
3.			
4.			
5.			
6.			
	15 = Total Cover		
50% of total cover: 7.5	20% of total cover: 3		
Herb Stratum (Plot size: 5')			
1. BLACKBERRY (RUBUS SP.)	7	YES	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	7 = Total Cover		
50% of total cover: 3.5	20% of total cover: 1.4		
Woody Vine Stratum (Plot size: 5')			
1. HONEYSUCKLE (LONICERA JAPONICA)	1-2	YES	FAC
2.			
3.			
4.			
5.			
	2 = Total Cover		
50% of total cover: 1	20% of total cover: 0.4		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 85.7 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: //

Profile Description: (Describe to the depth **needed to document the** indicator **or** confirm the **absence of indicators.**)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2								BROWN LAYER
2-10	10YR 6/2	60	5YR 4/6	40	C	M	SICL Lo	
10+								BROWN LAYER

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked **Sand Grains.** [2]**Location:** PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5)
- __ 2 cm Muck (A10) **(LRR N)**
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Dark Surface (S7)
- __ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- __ Thin Dark Surface (S9) **(MLRA 147, 148)**
- __ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- __ Umbric Surface (F13) **(MLRA 136, 122)**
- __ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- __ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10) **(MLRA 147)**
- __ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- __ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: NONE

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MITIGATION AREA - WETLAND I City/County: OHIO Sampling Date: 3-10-14
Applicant/Owner: ARMSTRONG COAL CO. - WARDEN WASTE SITE State: KY Sampling Point: WP115
Investigator(s): BILL SAMPSON, JOHN BOTTOM Section, Township, Range:
Landform (hillslope, terrace, etc.): FLOODPLAIN Local relief (concave, convex, none): CONCAVE Slope (%): <2
Subregion (LRR or MLRA): LRR N Lat: 37°24'17.3" Long: 87°03'37.9" Datum: WGS84
Soil Map Unit Name: BONNIE SILT LOAM NWI classification: PFO1B
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ✓ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): ____
Water Table Present?	Yes ____	No ____	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): ____

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: 115

Tree Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Red maple (Acer rubrum)	25	Yes	FAC
2. Pin oak (Quercus palustris)	10	Yes	FACW
3. Green ash (Fraxinus pennsylvanica)	5	No	FACW
4. River birch (Betula nigra)	5	No	FACW
5. Elm (Ulmus americana)	5	No	FACW
6.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		
Sapling Stratum (Plot size: 10')			
1. Sweetgum (L. styraciflua)	8	Yes	FAC
2. Red maple (A. rubrum)	15	Yes	FAC
3.			
4.			
5.			
6.			
	23 = Total Cover		
50% of total cover: 11.5	20% of total cover: 4.6		
Shrub Stratum (Plot size: 5')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5')			
1. DEAD			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size: 5')			
1. Honeysuckle (Lonicera japonica)	5	Yes	FAC
2.			
3.			
4.			
5.			
	5 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: 115

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3								BROWN LAYER
3-10	10YR 6/2	80	5YR 4/6	20	C	M	SiCLLO	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain In Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (If observed):

Type: NONE

Depth (inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: MITIGATION AREA – WETLAND J City/County: OHIO Sampling Date: 3-11-14
Applicant/Owner: ARMSTRONG COAL CO. – WARDEN WASTE SITE State: KY Sampling Point: WP 249
Investigator(s): BILL SAMPSON, JOHN BOTTOM Section, Township, Range: _____
Landform (hillslope, terrace, etc.): FLOOD PLAIN Local relief (concave, convex, none): CONCAVE Slope (%): 2
Subregion (LRR or MLRA): LRR N Lat: 37° 24' 04.6" Long: 87° 03' 30.6" Datum: WGS 84
Soil Map Unit Name: BONNIE SILT LOAM NWI classification: PFO 1B
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓ No _____	
Wetland Hydrology Present?	Yes ✓ No _____	

Remarks: SERIES OF CONNECTED/ADJACENT, NARROW, LINEAR WETLANDS AT SOUTHEAST PART OF SITE.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No _____	Depth (inches): _____
Water Table Present?	Yes _____	No _____	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: 249

Tree Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. SYCAMORE (PLATANUS OCCIDENTALIS)	5	NO	FACW
2. RIVER BIRCH (BETULA NIGRA)	5	NO	FACW
3. RED MAPLE (ACER RUBRUM)	15	YES	FAC
4. SWEETGUM (LIQUIDAMBAR STYRACIFLUA)	8	YES	FAC
5.			
6.			
	33 = Total Cover		

50% of total cover: 16.5 20% of total cover: 6.6

Sapling Stratum (Plot size: 10')			
1. RED MAPLE (A. RUBRUM)	15	YES	FAC
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5')			
1. DEAD			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 5')			
1. NONE			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: 249

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	7.5YR 6/1	55	7.5YR 5/6	45	C	M	SiCL Lo	SAME THROUGHOUT

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: NONE

Depth (Inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:

Wetland D (Off-site)

Wetland E (Off-site)

Wetland F (Off-site)

Wetland G (Off-site)

Wetland H (Off-site)

Wetland I (Off-site)

Wetland J (Off-site) -typical

Wetland J (Off-site)-typical

Wetland J (Off-site)-typical

TABLE 2

Warden Waste Site
Proposed Mitigation

Stream ID	Stream Type	Proposed Length/Acres	Mitigation Type
ON-SITE			
I-4	Intermittent	2100 ft.	restoration
I-5	Intermittent	874 ft.	"
E-28	Ephemeral	994 ft.	"
E-29	Ephemeral	992 ft.	"
E-30	Ephemeral	147 ft.	"
E-31	Ephemeral	174 ft.	"
E-32	Ephemeral	252 ft.	"
E-33	Ephemeral	264 ft.	"
E-34	Ephemeral	228 ft.	"
E-35	Ephemeral	338 ft.	"
E-36	Ephemeral	784 ft.	"
OFF-SITE			
P-1 (Williams Ck)	Perennial	5509 ft.	restoration
P-2 (Kronos Trib)	Perennial	1184 ft.	restoration
I-6, I-7, I-8, I-9	Intermittent	3429 ft.	preservation
E-37 to E-43	Ephemeral	3848 ft.	preservation
Wetland G to J	PFO	3.77 ac.	preservation
Wetland D to F	"	7.93 ac.	preserve/enhance
Adjacent Wet. D to F	"	10.43 ac.	creation
TOTALS:	Perennial	6693 ft.	restoration
	Intermittent	2974 ft.	restoration
		3429 ft.	preservation
	Ephemeral	4173 ft.	restoration
		3848 ft.	preservation
	PFO	3.77 ac.	preservation
		7.93 ac.	preserve/enhance
		10.43 ac.	creation